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JOURNAL

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WESTERN AUSTRALIA.

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THE JOURNAL OF AGRICULTURE.

This issue marks an improvement in the *Journal of the Department of Agriculture* of this State. In its enlarged form, and free distribution, the aim shall be to make the publication a reliable vehicle for the conveyance of information relating to rural affairs to those engaged in our agronomic industries. Farmers and others associated with the products of the soil are invited to send in their contributions concerning their experiences in matters of economic husbandry. The interchange of ideas among the practical and theoretical workers may lead to the elucidation of many problems which may be considered complex before investigation. The experiences of any farmer, in the conduct of his business, is always of value; and there is no absolute necessity for a farmer to be a literary genius to enable him to expound his views. We want his ideas, no matter how crude a form they are sent in, provided they are intelligible.

From all parts of the world we shall endeavour to collect the best data which the scientific and practical workers have shown to be most valuable in the economy of the farm. The information so obtained, together with that revealed by the experiments on the State farms, and Experts of the Department, will be published in the *Journal* from time to time. There are many momentous problems demanding solution in this State which, from an agricultural standpoint, is practically in its infantile stage. The enormous territory and variation in the character of the soils and climate of the State, demands special study and treatment to enable the full productive capacity of this country to be brought out. Examples from other parts of the world may be sought in dealing with these lands, and, with certain modifications, be made applicable here, but generally the State of Western Australia may be considered as *sui generis*, and must be dealt with accordingly.

As we have a large territory to operate upon, it would be almost impossible for the Director of Agriculture to personally give advice in matters of general farming in every instance; hence it is necessary to make use of the

Journal as far as practicable in disseminating information of a practical value to the farmers. The Director of Agriculture will make frequent visits to the farming centres and confer with the producers regarding their manner of working, the crops produced, and the methods of producing them. The fact cannot be overlooked that this Department has an important mission to fulfil—probably the most important in the State; and, when the situation is carefully reviewed, it is only too obvious that "there is so little done, and yet so much to do."

The principle of mixed farming must become a prominent feature in future operations; and towards that end the State farms will be used to demonstrate the most profitable methods. The results so attained will find their place in the *Journal* as they occur. By this means the unfolding of the economics of the farm will clearly show producers the pecuniary advantages that accrue on a combined system of husbandry which may be said to include dairying, pig-raising, lamb-breeding, poultry, the production of cereals, and the minor products which all more or less affect the main industry.

C. F. CHAPLIN,
Director of Agriculture.

PRODUCTION OF LUCERNE.

Compiled by the DIRECTOR OF AGRICULTURE.

In many parts of the State lucerne can be grown successfully. This is made apparent by the several small areas seen in several districts more or less remote from each other. The fact cannot be overlooked, however, that the majority of farmers are prone to disregard what may be termed the true basis for raising lucerne, one of the most valuable of fodder plants. The conditions of soil and climate in this country differ so widely to those in other parts of the world where lucerne is largely produced that special treatment is necessary to secure a reliable and profitable crop or a stand that will yield well for some years without renewal.

The composition of the lucerne plant, revealed by chemical analyses, shows that it ranks among the best of animal foodstuffs. When the plant was coming into bloom, the analysis showed that it contained the following percentages:—Protein, 18·47; fat, 1·14; carbohydrates, 64·04; water, 4·40; ash, 11·95. It may be stated that the value of the feeding stuff is measured by the quantity of protein, and that an increase in carbohydrates generally indicates a deterioration in its feeding quality. Bran analysis compared with that of lucerne shows that lucerne is the more valuable as a fodder, its constituents being—Protein, 15·4; fat, 4·0; carbohydrates, 62·9; water, 11·9; ash, 5·8.

Lucerne will grow in any soil that will produce maize, and in a good many soils in which maize will not grow. On the black soils of the Darling Downs, in Queensland, fine stands of the crop may be seen, and also its resultant effect in fat lambs ready for market at 13 weeks old. The soil in which lucerne does best is alluvial, well drained, and not subject to inundation. If water remains on the crop for 48 hours, it will probably kill it. The plant food it requires chiefly is potash, lime, magnesia, phosphoric acid, and sulphur. A soil formed of decomposed limestone is ideal for the growth of lucerne. It will also thrive exceedingly well in a soil composed of almost pure sand, provided the water table is within reach of its roots and the underground water contains enough mineral to supply it with a large quantity of its food.

LUCERNE PLANT AND FLOWER.

Experiments made at the Manhattan Experiment Station and reported upon by Mr. Geo. Clothier, the manager, shows that the difference in yields from bottom and upland was not due to a disparity in fertility of the soil, but to a difference in the available water supply to the roots. Although lucerne has been known to survive periods of excessive dryness so severe as to cause buffalo grass to perish, yet it is an undoubted fact that the plant uses as much water in the production of a ton of dry matter as any other

crop. It is not likely to be a permanent and heavily yielding crop upon a soil underlaid with an impermeable substratum of rock or hard-pan within two or three feet of the surface.

Preparing the Soil.

In the preparation of the soil for a stand of lucerne, no better advice can be given than that contained in the report of the Manhattan station previously referred to. The report, which is based on actual experience, states that although successful stands of lucerne have been secured by simply scattering the seed among the prairie grasses and harrowing it in with an Acme or disc harrow, or by seeding after the breaking-up plough in sod land, such methods are not to be recommended. If the land is so weedy that it cannot be cleaned by cultivation, it should be fallowed for one season prior to the seeding. If it is desirable to subsoil the land, this should be done a year before seeding, and may be followed either by fallow or a cultivated crop. Time enough should intervene between the subsoiling and the seeding to allow the soil to settle, and to store a bountiful supply of moisture against dry weather. Although lucerne roots penetrate very stiff soils, it generally pays to subsoil such to a depth of 15 to 20 inches, so that the young plant roots may not meet with discouraging difficulties too early in life. In a fairly porous soil, a vigourous lucerne plant 30 days' old will have a tap-root 15 to 18 inches long. The soil should be put in such a perfect tilth that the farmer need have no fears of dry weather or weeds to injure his young lucerne. The seed bed should be as fine as an onion bed, and the subsurface rather firm and well supplied with moisture. If the soil is deficient in humus, a liberal coating of barnyard manure, ploughed under at the time of subsoiling, will add greatly to its physical condition, and thus help to start the young plants out in life with less difficulties to encounter. If the soil is very sandy, the manure will be of great value in preventing the sand from blowing and in conserving moisture. A very sandy soil is not benefited by deep ploughing or subsoiling. If the soil is heavy, and it is not practicable to subsoil, it should be ploughed to a depth of eight or ten inches several months prior to seeding. The land is allowed to lie fallow after this treatment, or has been autumn ploughed. It should be thoroughly disced every three weeks during the summer or autumn, as the case may be, to keep a dust mulch on the surface and prevent evaporation.

If the soil has had the thoroughly extended preparation outlined above, the immediate preparation will be very simple, and may be accomplished by running a smoothing harrow over the ground a day or two before the drill. If avoidable, lucerne should never be sown on freshly-ploughed land. After the plants have attained a firm hold in the soil, the ground may be harrowed once or twice a year, preferably when the plants are at rest. This is of great advantage in destroying insects and assisting in the conservation of moisture.

In common with other leguminous plants, lucerne has the ability to feed indirectly upon the nitrogen of the atmosphere. This is accomplished by means of organisms or soil bacteria, which dwell in the little excresences or tubercles on the roots of the lucerne, and take up the nitrogen gas and convert it into food for their host. The bacteria are not frequent in new soils, and it sometimes happens that lucerne or clover will not thrive on new land until the organisms have been introduced. If lucerne has not been grown in

a neighbourhood it might be profitable to obtain some soil from a distant lucerne field, and sow with the seed in order to inoculate the land with the nutrifying bacteria.

Seeding.

In this State the time of seeding is of great importance. The lucerne seed should be sown at a time when there is an absence of unfavourable weather conditions, rather than at any particular season. As soon as there is a likelihood of all danger from frost being over, the lucerne could be sown. Cold rains, however, when excessive, sometimes cause the young plants to rot off, as would be the case with the adult plants when submerged for two or three days. The young plant is so sensitive to standing or stagnant water that an intelligent irrigator would not dare to put an inch of water upon his field—after seeding—before the plants were six weeks old, even if he ran a risk of their perishing from drought It is necessary, however, in this country, to sow the seed some weeks before the dry weather period begins, so as to insure its receiving sufficient moisture to thoroughly establish it, and to enable it to tide over the period when moisture is absent. While the lucerne is among the most tender plants when young, it becomes one of the most vigorous and robust when firmly established in a congenial habitat.

It would be advisable to examine the soil in which lucerne is to be planted, to ascertain at what depth the subterranean water is from the surface. If the roots of the plant find their way into stagnant water the lucerne will die. In cold, wet soils it will not live, hence the necessity for drainage. If sown broadcast, from 20 to 25 pounds of seed will be required per acre; if drilled, 15 to 20 pounds. The seeds should be covered about one inch in depth, unless the surface is very dry, when a somewhat greater depth is admissible. A good method to secure a better distribution of plants is to sow 10 pounds of seed, running the drill in one direction across the field, and then cross-drill with the other 10 pounds. Thick sowing improves the quality of the hay, but the plant has wonderful ability to adapt itself to either thick or thin sowing. One good stout healthy crown has been known to produce 360 stems at one cutting. When seeding broadcast, the seed should be covered with a light smoothing harrow, or with a brush drag. The majority of farmers seem to prefer broadcasting, presumably because they have less difficulty in getting the plants covered shallow enough than with a drill. In very sandy districts, where the sand is liable to blow and cut off the stems of the young lucerne, it has been found beneficial to sow with the lucerne half a bushel of oats to the acre, as a protection against the blowing sand. The oat plants must be removed before they have an opportunity to shade the lucerne, using a mowing machine the same as if they were weeds. It is a waste of time to attempt to grow the crop on weedy ground, the young plant being very tender and easily smothered out by rank weeds.

FRUIT FLY PARASITES.

By George Compere, Government Entomologist.

The (*Staphylinidæ*) beetles I recently brought to this State from Brazil, which are predaceous upon the larvæ of the fruit fly, are multiplying very rapidly in the insectary. Hundreds of the young larvæ, in various stages of development, are to be noticed in the decaying fruits and under the fruit boxes, feeding upon the fruit-fly larvæ; and there is now no apparent reason why we should not have thousands of these beetles for distribution in infested orchards by next spring.

The appearance of these beetles is very characteristic, the body being about an inch in length and slender, the wing covers very short, but the wings fully developed, exceeding the abdomen in length; when not in use, the wings are folded beneath the short wing covers. The abdominal segments, of which there are six in number, are freely movable. The adult beetle (Fig. 1) is shiny black in colour, with the last two segments of the abdominal segments brownish red. These beetles have a habit when disturbed of raising the tip of the abdomen in a very threatening manner, as if they could sting, but in reality they have no sting; but these threatening motions are often very effective in keeping at bay some enemy. The beetles are swift runners as well as flyers. Fig. 2 shows the unfolded wing. There are many thousand species of the (*Staphylinidæ*) beetles recorded from various parts of the world, and the major portion of them feed upon decayed animal and vegetable matter. These beetles were very abundant on the occasion of my two visits to Brazil; they were found in every garden or orchard visited.

I collected no larvæ of the (*Staphylinidæ*) beetles, as I did not care to take the chance of introducing their parasites, and also that I would not have been able to supply them with sufficient food on the long journey.

Ichneumon parasite (Fig. 3) represents the species which I brought from Brazil, and which is parasitic upon the fruit-fly larvæ. Of these ichneumon parasites, I did not bring a very large supply with me, as I was compelled to utilise the greater part of the fruit-fly maggots collected for food in order to keep the *Staphylinidæ* beetles alive; and from those placed in a breeding jar in the insectary there has, up to the present time, been six females and three males liberated, which have issued, and no doubt others will follow.

Codlin Moth Parasites in California.

The following interesting accounts of the codlin moth parasites, which were recently imported into California by Geo. Compere, entomologist of this State, have been taken from American publications of recent date. The *California Fruit Grower*, in its issue of 13th May, 1905, says in part:—"In regard to those which he brought over last winter and which, with their progeny, have been liberated in the apple orchards of this State, it is said that they are doing exceptionally well, and little doubt is expressed but that they will do all that is hoped for from them. Letters have been

received from various parts of the State by the Horticultural Commissioner, stating that numbers of the young parasites have been found in orchards, showing that they find themselves at home here and are multiplying rapidly. Mr. Carnes says that in Fresna county he found three generations on the trees—those that were first liberated in the orchards, their progeny, and the progeny of second generation. Sonoma county reports nearly all large apple growers supplied with the parasites, which are doing effective work and increasing rapidly." The *Rural California*, in its May issue, 1905, has the following highly interesting account under the heading of codlin moth parasites" :—" Horticultural Commissioner Bremner, of Sonoma county, recently announced a most important discovery as the result of experiments with the codlin moth parasite recently imported into California for the benefit of the apple growers. On the 21st March he put three adults in an orchard, and within thirty days several cocoons had hatched. Thus far, Mr. Bremner has demonstrated that at least three generations are hatched in a season, and he expects that it will finally reach four, or perhaps five. Inasmuch as the hatches are in the ratio of 100 to one for each adult, the ease and celerity with which the parasites will multiply and perform their function of preying upon the codlin moth are readily appreciated."

ARTIFICIAL FERTILISERS.

By Percy G. Wicken.

Owing to the greatly increased demand for information on the subject of fertilisers which is now being made, and the number of inquiries made while travelling about the country, I have rewritten the attached notes in the hope that they may prove of benefit to those desiring information on the subject of fertilisers. The time has now come when it is being realised in the State, the same as it has been done in the Eastern States for some time past, that it is profitable to apply a fertiliser to almost all crops, even in good soil. In a rich soil it is possible to raise a certain number of crops without fertilisers but this is only at the expense of the soil, and a day will come, sooner or later, when the crop will no longer be profitable, and then, the soil being exhausted, it is a much more expensive matter to restore it to a profitable condition. The fertiliser trade is increasing every year, and compared to the quantity used a few years ago, is now assuming fair proportions. Bonedust still remains at a high figure, the demand in the Eastern States being almost equal to the supply; and very little is available for export, except at a high value. Potash manures are still in very little demand, the bulk of the trade being done in superphosphates, which only supply one ingredient, viz., "phosphoric acid," to the soil.

Farmyard Manure.

Although we are here dealing with the subject of artificial fertilisers, I do not wish in any way to decry the value of stable or farmyard manure. Well

made farmyard or stable manure is the best fertiliser that can be obtained, but the supply is limited, and if the wheat-grower had to depend on this source for his supply of fertiliser his crop would go very short; and here artificial manures come to our aid. Most farmers make a larger or smaller quantity of stable manure, but only enough to manure a very small portion of the area of land which they cultivate, and are consequently forced to use artificial. Farmyard manure has both its advantages and disadvantages. Where a plentiful supply can be obtained and placed on the ground at a reasonable amount of expense, it is of great benefit, as apart from the value of its manurial ingredients it is of mechanical benefit to the soil, and supplies a large quantity of humus, of which our soils in general are much in need. But its disadvantages are in the great bulk of substance that requires handling in comparison to the small amount of plant food supplied. The chemists tell us that the amount of plant food contained in one ton of well rotted and well preserved farmyard manure is—nitrogen, 8lbs.; phosphoric acid, 6lbs.; potash, 6lbs.; and this amount is contained in less than one cwt. of some of the artificial manures, that set down for onions for instance. It is worth, at the standard rates at which the following manures are based, about 9s.; while one cwt. of manure recommended for onions contains—nitrogen, 6lbs.; phosphoric acid, 9lbs.; and potash, 11lbs., at a cost of 8s. 4d. Farmyard manure, to contain even this small quantity of plant food, requires to be well preserved, while most of that made is exposed to the weather, the liquid allowed to leach away, and the manure is of very little value. The quality of farmyard manure depends very largely also on the quality of the food supplied to the animals, and to a variety of other causes with which it is not proposed to deal in this article. The ingredients contained in farmyard manure are all those required in a complete manure, and farmyard manure should be saved and made into a compost for future use wherever it can be obtained.

Artificial Manures.

In the following notes I have endeavoured, in as plain terms as possible, to indicate, on broad lines, as to what manures should be used for various crops. I have purposely refrained from using any scientific terms. I often have occasion to tell a farmer to use a manure containing, say, six per cent. of potash or 10 per cent. of nitrogen, but I find that he is not much wiser for the information, as he does not know how to obtain the necessary mixture. The manures mentioned are all simple ingredients, and can all be purchased in the Perth Market, and I have, in each instance, given the cost per acre, so that any one requiring to use these manures can form an idea as to what the cost will be before they make a start, and can then regulate the area under crop in accordance with the amount of money they are prepared to lay out. It is a well-known fact that one acre well manured and looked after will yield a larger crop than two acres poorly manured and badly looked after, crops, like livestock, yield a return in proportion to the amount of food and attention bestowed on them.

Prices of Manures.

The following may be taken to be about the average price charged in Perth for quantities of not less than two cwt. (bag lots) of any one manure. The price is, of course, open to alteration subject to the market fluctuations, rate of freight, the terms required by the purchaser for payment, and the quantity required; the man who can afford to purchase a truck load for

cash being, of course, able to secure better terms than those requiring only small quantities and extended credit:—

Sulphate of Potash, containing 53 per cent. of potash, £16 per ton, equal to about 6s. per unit.

Nitrate of Soda, containing 15 per cent. of nitrogen, £14 per ton, equal to 18s. 8d. per unit.

Sulphate of Ammonia, containing 20 per cent. of nitrogen, £17 per ton, equal to 17s. per unit.

Thomas' Phosphate, containing 18 per cent. of phosphoric acid, £3 10s. per ton, equal to 3s. 10d. per unit.

Bone-dust, containing 4·5 per cent. of nitrogen and 17 per cent. of phosphoric acid, £7 per ton.

Superphosphate, containing 25 per cent. of phosphoric acid, at £6 10s. per ton.

Blood Manure, containing 11 to 12 per cent. of nitrogen, at £6 per ton.

Unit Values of Manures.

The unit value of a manure is the value of each 1 per cent. of the ingredients contained. Taking sulphate of potash for an example, a manure containing 53 per cent is worth £16 per ton; a manure, therefore, containing 54 per cent. is worth 6s. more; a manure containing 52 per cent. is worth 6s. less, and so on with the other ingredients. The unit value of nitrogen contained in bone-dust, blood manure, offal, etc., is not so valuable as that contained in the more soluble salts, such as sulphate of ammonia. The value may be taken as about four-fifths; that is to say, that if the unit value of nitrogen in sulphate of ammonia is 17s. per unit, that in bone-dust is 14s. 3d.

Phosphoric acid is contained in superphosphate, etc., in three forms: "water soluble," "citrate soluble," and "acid soluble." The "water soluble" may be valued at 5s. 2d. per unit, the "citrate soluble" at 3s. 10d., and the "acid soluble" at 2s. 7d. per unit. An analysis of superphosphate will state the percentage of "water soluble," "citrate soluble," and "acid soluble." Where "citrate soluble" is quoted this means that the phosphoric acid is insoluble in water but soluble in citrate of ammonia, and is worth about half the difference between the "water soluble" and "acid soluble."

The unit value will therefore be:—

Perth.

	s.	d.
Nitrogen.		
In Ammonium Salts and Nitrates	17	0
Blood, Bones, Offal, etc.	14	3
Potash.		
Potash Salts	6	0
Phosphoric Acid.		
Water, Soluble	5	2
Citrate, Soluble	3	10
Insoluble	2	7
In Bones, Offal, etc.	3	0

Having these unit values near at hand, it is a very simple matter to arrive at the value of any manure offered for sale. Supposing, for instance, a mixed manure, composed largely of bone-dust, is offered for sale containing nitrogen 4·5 per cent., potash 5 per cent., phosphoric acid 20 per cent., we multiply the percentage by the unit value and arrive at the value of the manure thus:—

		£ s. d.
Nitrogen	4·5 x 14/3	3 4 2
Potash	5 x 6/0	1 10 0
Phosphoric Acid	20 x 3/0	3 0 0
	Value at Perth prices	7 14 2

In submitting the following list of manures of various crops, it must be borne in mind that it is impossible to give a manure that is suitable for every sort of soil and all conditions, and the manures mentioned can only be taken for a fair average soil, and may require to be varied for different districts. It is best to determine what is required, by actual experiment, and a very simple way to determine the ingredients deficient is as follows, which is recommended by Ville, a distinguished chemist, as a practical analysis of the soil:—

Sow, in close proximity and upon a similar piece of land, a small patch of wheat and a small patch of peas. The land should be unmanured, and both patches should have received the same previous treatment. The results of these two crops will furnish you with a guide as to the quantities of nitrogen, phosphoric acid, and potash available in the soil, quite as reliable as a chemical analysis.

If the two crops flourish equally well your land is well supplied with the three ingredients above named.

If the wheat crop fails and the peas flourish nitrogen is wanting, and the advisability of applying a nitrogenous manure becomes plain.

If, on the contrary, the peas are sickly, the cause is probably deficiency in potash and phosphoric acid which must be supplied.

Manures for various Crops.

Manures for Wheat and Cereals.

	Quantity.	Cost. £ s. d.
Bone-dust, or boiling down refuse containing 7 per cent. nitrogen and 9 per cent. phosphoric acid ...	560lbs. ...	1 10 0
Superphosphate	560 ,, ...	1 12 6
Sulphate of Potash	168 ,, ...	1 4 0
	11½cwt. ...	£4 6 6

This mixture will cost, approximately, 7s. 6d. per cwt., and should be applied at the rate of 3cwt. per acre, and will cost £1 2s. 6d. per acre.

It will supply to the ground per acre:—

Nitrogen	10lbs.
Phosphoric Acid	47 ,,
Potash	22 ,,

COLD HARBOUR.

W. L. HOOPS' HOMESTEAD.

or, if using Thomas' phosphate, apply when sowing seed :—

	Quantity.		Cost. £ s. d.
Thomas' Phosphate	336lbs.	...	0 10 6

And as a top dressing in spring—

			£ s. d.
Sulphate of Ammonia	448lbs.	...	3 8 0
Superphosphate	448 „	...	1 6 0
Sulphate of Potash	336 „	...	2 8 0
	11cwt.		£7 2 0

or about 13s. per cwt.

Apply the mixture at the rate of about 1cwt. per acre in spring, and the total cost will be £1 3s. 6d. per acre, and will supply about :—

Nitrogen	8lbs.
Phosphoric Acid	64 „
Potash	14 „

Thomas' phosphate contains a considerable percentage of lime, and is not so satisfactory on a limestone soil as superphosphate, but in clayey or peaty soils, or soils deficient in lime, it is especially valuable on account of the quantity of lime it contains. In mixing manures together, Thomas' phosphate must not be mixed with a manure containing sulphate of ammonia, as the lime sets free the ammonia and the nitrogen is lost. This fact must be borne in mind if it is desired to substitute Thomas' phosphate for superphosphate in any of these mixtures.

This manuring for wheat may seem heavy to the farmer who is accustomed to use about 56lbs. of superphosphate to the acre. But when we remember that each bushel of wheat takes from the soil, approximately, 1½lbs. nitrogen, ⅔lb. phosphoric acid, and 1lb. potash, it is not so. Our average yield of wheat for the State is, in round numbers, 12 bushels per acre; therefore, every crop of wheat removes from the soil, per acre, 18lbs. nitrogen, 8lbs. phosphoric acid, and 12lbs. potash. It therefore stands to reason that the farmer who only applies, say, ½cwt. superphosphate per acre, equal to 6lbs. of phosphoric acid, must sooner or later come to the end of the available supplies in the ground. Although in manuring for wheat we find the crop respond to the application of phosphatic fertilizers, only a small proportion of the phosphoric acid contained is immediately available for the crop, and the lime contained frees the other ingredients in the soil for the use of the plant. However, we cannot go on taking 18lbs. of nitrogen per acre out of the ground for ever without we replenish the supplies either by artificial fertilizers, by fallowing, or by green manuring.

Oats

require about the same manure as wheats, except perhaps a little more potash, as the straw of the oat contains more potash than that of wheat.

Barley,

if for malting purposes, requires less nitrogenous manure, as the grain produced by the application of nitrogenous fertilizers affects the keeping qualities of the beer.

Pasture Grasses.

	Quantity.	Cost. £ s. d.
Sulphate of Ammonia	448lbs. ...	3 8 0
Superphosphate	560 ,, ...	1 12 6
Sulphate of Potash	224 ,, ...	1 12 0
	11cwt.	£6 12 6

Cost of mixture per cwt., 12s.

Apply at time of sowing seed, or as a top dressing in established pastures, at the rate of 3cwt. per acre, and the cost will be £1 16s., and will supply to the ground per acre:—

Nitrogen	24lbs.
Phosphoric Acid	37 ,,
Potash	28 ,,

Leguminous Crops.

BEANS, PEAS, AND CLOVERS.

	Quantity.	Cost. £ s. d.
Bone-dust	168lbs. ...	0 10 6
Superphosphate	560 ,, ...	1 12 6
Sulphate of Potash	448 ,, ...	3 4 0
	10½cwt.	£5 7 0

Cost of mixture per cwt., 10s. 1d.

Apply at the rate of 3cwt. per acre, it will cost £1 10s. 3d., and will supply to the ground per acre:—

Nitrogen	2lbs.
Phosphoric Acid	40 ,,
Potash	60 ,,

Leguminous crops require no nitrogen, they having the power of obtaining their supplies of nitrogen from the air. The manures they require are lime, potash, and phosphoric acid. In soils that are deficient in lime a heavy dressing of lime is necessary for this crop.

Cabbages, Cauliflowers, etc.

Apply at time of transplanting or sowing seed:—

		Cost. £ s. d.
Bone-dust	560lbs. ...	1 15 0
Sulphate of Potash	224 ,, ...	1 12 0
	7cwt.	£3 7 0

Cost of mixture per cwt., 9s. 7d

Apply at the rate of 3cwt. per acre.

When the heads are just beginning to form, apply as a top dressing:—

		Cost. £ s. d.
Sulphate of Ammonia	112lbs. ...	0 17 0
Superphosphate	112 ,, ...	0 6 6
Sulphate of Potash	56 ,, ...	0 8 0
	2½cwt.	£1 11 6

Cost of mixture per cwt., 12s. 7d.

Apply at the rate of 112lb. per acre. The total cost of the two applications will be £2 1s. 4d., and will supply to the soil :—

Nitrogen	18lbs.
Phosphoric Acid	58 ,,
Potash	61 ,,

Maize and Sorghum.

			Cost. £	s.	d.
Blood Manure	336lbs.	...	0	18	0
Bone-dust	224 ,,	...	0	14	0
Superphosphate	448 ,,	...	1	6	0
Sulphate of Potash	112 ,,	...	0	16	0
	10cwt.		£3	14	0

Cost of mixture per cwt., 7s. 5d.

Apply at the rate of 4cwt. per acre, at the time of sowing the seed, the cost will be £1 9s. 8d., and will supply to the ground per acre :—

Nitrogen	18lbs.
Phosphoric Acid	62 ,,
Potash	24 ,,

Pumpkins, Melons, etc.

			Cost. £	s.	d.
Blood Manure	448lbs.	...	1	4	0
Superphosphate	560 ,,	...	1	12	6
Sulphate of Potash	112 ,,	...	0	16	0
	10cwt.		£3	12	6

Cost of mixture per cwt., 7s. 3d.

Apply a good handful to each hill, or at the rate of 2cwt. per acre, the cost will be 14s. 6d., and will supply to the ground per acre :—

Nitrogen	9lbs.
Phosphoric Acid	28 ,,
Potash	12 ,,

Blood manure is not always obtainable in this market, and some other form of nitrogenous manure must be substituted for it containing the same amount of nitrogen.

Tomatoes.

			Cost. £	s.	d.
Sulphate of Ammonia	336lbs.	...	2	11	0
Superphosphate	560 ,,	...	1	12	6
Sulphate of Potash	336 ,,	...	2	8	0
	11cwt.		£6	11	6

Cost of mixture per cwt., 12s.

Apply at the rate of 4cwt. per acre, the cost will be £2 8s., and will supply to the ground per acre :—

Nitrogen	24lbs.
Phosphoric Acid	52 ,,
Potash	60 ,,

Onions.

			Cost. £ s. d.
Blood Manure	448lbs.	...	1 4 0
Bone-dust	336 „	...	1 1 0
Superphosphate	112 „	...	0 6 6
Sulphate of Potash	224 „	...	1 12 0
	10cwt.		£4 3 6

Cost of mixture per cwt., 8s. 4d.

Apply a little before or at the time of sowing seed, at the rate of 4cwt., and 1cwt. per acre, as a top dressing when plants are well forward, cost £2 1s. 8d., and will supply to the ground :—

Nitrogen ...	31lbs.
Phosphoric Acid ...	45 „
Potash ...	54 „

Potatoes.

			Cost. £ s. d.
Blood Manure ...	448lbs.	...	1 4 0
Superphosphate	560 „	...	1 12 6
Sulphate of Potash	224 „	...	1 12 0
	11cwt.		£4 8 6

Cost of mixture per cwt., 8s.

Apply at the rate of 4cwt. per acre in drills with the seed, at a cost of £1 12s., and this will supply to the ground :—

Nitrogen ...	18lbs.
Phosphoric Acid ...	50 „
Potash ...	40 „

Mangels.

			Cost. £ s. d.
Sulphate of Ammonia	448lbs.	...	3 8 0
Bone-dust	224 „	...	0 14 0
Superphosphate	336 „	...	0 19 6
Kainait ...	448 „	...	1 0 0
	13cwt.		£6 1 6

Cost of mixture per cwt., 9s. 4d.

Apply at the rate of 5cwt. per acre, at a cost of £2 6s. 8d., and this will supply to the ground per acre:—

Nitrogen ...	37lbs.
Phosphoric Acid ...	50 „
Potash ...	22 „

Mangels are a very gross feeding plant, and require a liberal supply of manure. They are largely benefited by the application of salt, and if kainait cannot be obtained and sulphate of potash has to be substituted in its place, a dressing of salt at the rate of 200lbs. or 300lbs. per acre will prove beneficial.

Turnips, Rape, etc.

		Cost. £ s. d.
Sulphate of Ammonia	112lbs. ...	0 17 0
Bone-dust	336 „ ...	1 1 0
Superphosphate	336 „ ...	0 19 6
	7cwt.	£2 17 6

Cost of mixture per cwt., 8s. 2d.

Apply at the rate of 3cwt. per acre, and the cost will be £1 4s. 6d., and will supply to the ground per acre:—

Nitrogen	15lbs.
Phosphoric Acid	63 „

Tobacco.

		Cost. £ s. d.
Sulphate of Ammonia	448lbs. ...	3 8 0
Superphosphate	336 „ ...	0 19 6
Sulphate of Potash	336 „ ...	2 8 0
	10cwt.	£6 15 6

Cost of mixture per cwt., 13s. 6d.

Apply at the rate of 5cwt. per acre, at a cost of £3 7s. 6d., and this will supply to the ground per acre:—

Nitrogen	45lbs.
Phosphoric Acid	41 „
Potash	80 „

Grape Vines.

		Cost. £ s. d.
Sulphate of Ammonia	448lbs. ...	3 8 0
Superphosphate	448 „ ...	1 6 0
Sulphate of Potash	224 „ ...	1 12 0
	10cwt.	£6 6 0

Cost of mixture per cwt., 12s. 7d.

Apply at the rate of 4cwt. per acre, and the cost will be £2 10s. 4d., and will supply to the ground per acre:—

Nitrogen	36lbs.
Phosphoric Acid	44 „
Potash	42 „

In soils that are deficient in lime the superphosphate should be reduced by one-half and gypsum used instead of it.

Citrus Fruits.

		Cost. £ s. d.
Bonedust	560lbs. ...	1 15 0
Superphosphate	224 „ ...	0 14 0
Sulphate of Potash	336 „ ...	2 8 0
	10cwt.	£4 17 0

Cost of mixture per cwt., 9s. 8d.

Apply at the rate of 4lbs. per tree (according to size), equal to 400lbs. per acre, at a cost of 34s., or 4d. per tree.

This will supply to the ground per acre—

Nitrogen	8lbs.
Phosphoric Acid	61 „
Potash	60 „

Apples and Pears.

		Cost. £	s.	d.
Bone-dust	560lbs. ...	1	15	0
Superphosphate	336 „ ...	0	19	6
Sulphate of Potash	336 „ ...	2	8	0
	11cwt.	£5	2	6

Cost per cwt. of mixture, 9s. 4d.

Apply at the rate of 3½lbs. per tree (according to the size of the tree), equal to 350lbs. per acre, at a cost of 28s. 6d., or 3½d. per tree.

This will supply to the ground per acre—

Nitrogen	6lbs.
Phosphoric Acid	51 „
Potash	42 „

If the trees are looking yellow, it is probably due to a want of nitrogen, and a dressing of sulphate of ammonia, at the rate of 1lb. per tree, will probably prove beneficial. The extra cost will be about 1½d. per tree.

Stone Fruits.

		Cost. £	s.	d.
Sulphate of Ammonia	224lbs. ...	1	14	0
Superphosphate	560 „ ...	1	15	0
Sulphate of Potash	224 „ ...	1	12	0
	9cwt.	£5	1	0

Cost of mixture per cwt., 11s. 3d.

Apply at the rate of 3½lbs. per tree (according to size), equal to 350lbs. per acre, at a cost of £1 15s. 3d. per acre, or 4¼d. per tree.

This will supply to the ground per acre—

Nitrogen	16lbs.
Phosphoric Acid	48 „
Potash	39 „

Standards adopted.—The standards adopted in working out the above calculations are as follow :—

		%		%
Boiling down refuse ...	Nitrogen...	7	Phosphoric Acid...	9
Bone-dust	Nitrogen...	4	Phosphoric Acid...	20
Superphosphate ...	... ...		Phosphoric Acid...	25
Sulphate of Potash ...	... ...		Potash	53
Blood manure ...	... ...		Nitrogen	11
Sulphate of Ammonia	... ...		Nitrogen	20

The percentages given may be considered rather high, but a good sample of each manure should contain the quantities stated.

Substitution.—In the event of one manure being substituted for another, care must be taken to use a quantity that will give the same amount of the ingredient required as the manure which is to be replaced.

For instance, supposing blood manure or boiling down refuse is unobtainable, and sulphate of ammonia has to be substituted in its place, only about half the quantity will be required, as 100lb. of sulphate of ammonia contain 20lb. of nitrogen, and 100lbs. of blood manure 11lbs.; 100lbs. boiling down refuse, 7lbs. Nitrate of soda is not mentioned in the formulas given on account of its cost, but may be substituted for sulphate of ammonia if occasion requires; it is more expensive than sulphate of ammonia, and has to be imported from abroad, while sulphate of ammonia is produced within the States, both in Sydney and Melbourne. Each 100lbs. of sulphate of ammonia contains 20lb. of nitrogen, at a cost of 17s., and each 100lb. of nitrate of soda contains 15lbs., at a cost of 14s. The nitrogen in the former case costing 10d. per lb., and in the latter 11d. per lb. It is principally a question of cost in the choice between the two manures. In substituting one manure for another care should be taken to try and substitute a manure somewhat similar in condition to that replaced; for instance, it is better to substitute boiling down refuse or nipho for blood manure than it is to use sulphate of ammonia. In potash manures, kainait may be substituted for sulphate of potash. Kainait is a whitish salt, and contains one-fourth the percentage of potash (13 per cent.) that sulphate of potash does, and is quoted at one-quarter the price, therefore it is necessary to use four times the quantity to supply an equal amount of potash.

In substituting one form of superphosphate for another care must be taken to supply one having about the same percentage of "water soluble" phosphoric acid. If basic slag or Thomas's phosphate is used instead of bone phosphate, it had better be applied separately; as noted under the head of "Manures for Wheat," it is very largely composed of acid soluble phosphoric acid, and contains 18·31 per cent.; its actual value as a manure at current Perth rates would be about 47s. 3d., whereas the price asked is £4.

Manure for Small Areas.—In all the manures mentioned in the above notes, I have quoted the amounts per acre as a basis, as in all farming operations an acre is the standard measurement. However, for those having only small areas of land it is very easy to calculate the quantities to use. For a square chain, or one-tenth of an acre, the quantity required will be one-tenth of the amount recommended, or say, 11lbs. per chain for each cwt. of manure. To come to a smaller area again, for each square yard will be required about one-third of an ounce for each cwt. of manure to be applied per acre.

For those wishing to use these formulas for a small area, and who only require to use a small quantity of the manures mentioned, it will be a very simple matter to strike off the two last figures mentioned; thus, for example, that for onions:—

Blood manure...	448lbs.	will be	4lbs.
Bone-dust	336lbs.	„	3lbs.
Superphosphate	112lbs.	„	1lb.
Sulphate of Potash	224lbs.	„	2lbs.

and mix any quantity you may require in the proportions of 4, 3, 1, 2, and this will give a result sufficiently accurate for garden purposes.

What Crops take from the Soil.

A crop of wheat yielding 30 bushels of grain to the acre, or about 2 tons of grain and straw, removes from the soil during the period of growth 48lbs. of nitrogen, 21lbs. of phosphoric acid, and 29lbs. potash. The wheat crop depends entirely upon the soil for its supply of nitrogen. Forty-eight lbs. nitrogen is equivalent, roughly speaking, to about ·003 per cent. in a soil of 6 inches deep, a quantity much less than that contained in the average soil, which is about ·1 per cent. It will be seen by this that if the nitrogen in the soil were available, there would be plenty in the poorest soil to supply a number of crops; but the crop does not possess the power of utilising the soil nitrogen to its full extent, and therefore the application of soluble nitrogenous manure is desirable to furnish the crop with a full supply of nitrogen. In a wheat or cereal crop, three-quarters of the nitrogen is contained in the grain, and about one-quarter in the straw. Twenty-one lbs. of phosphoric acid represents about ·001 per cent. phosphoric acid in a soil of average quality and depth, which is contained about ten times over. The same remarks apply to the potash.

Other Crops take from the Soil.

	Nitrogen. lbs.	Phosphoric Acid. lbs.	Potash. lbs.
Grass (hay) per ton	32·6	8·1	34·0
Wheat, per bush.	1·5	·8	1·0
Potatoes, per ton	7·9	3·5	12·6
Turnips „	6·5	1·9	8·7
Mangels „	6·3	2·1	13·6
Beans, per bush. (including straw)	3·5	1·0	2·2
Clover, per ton	51·0	12·5	42·0

The leguminous plants have the power of absorbing their supplies of nitrogen from the air, and are not benefited in any way by the application of nitrogenous manures. These leguminous crops contain a large percentage of lime, and are specially benefited by the application of lime. The quantity of lime taken by the above-mentioned crops from the soil is—

Cereals	about 10lbs.
Grass	„ 32lbs.
Potatoes	„ 27lbs.
Turnips	„ 70lbs.
Mangels	„ 43lbs.
Beans	„ 29lbs.
Clover	„ 90lbs.

It is this power that the leguminous crops possess of extracting their nitrogen from the air that makes them of such especial value for ploughing in for green manure. Green manuring is the cheapest form in which nitrogen can be supplied to the ground. Crops such as cow-pea, clover, and soy beans are especially valuable for this purpose. By cultivating and ploughing into the ground a crop of cow-pea weighing 4,000lbs., or about 2 tons of pea straw and grain to the acre, we return to the soil about 106lbs. of nitrogen, which, purchased in the market at current rates, is equal to 5cwt. of sulphate ammonia at 17s. per cwt., or £4 5s., without taking into consideration the benefit derived from the humus ploughed into the soil. And now that the means of cultivating and distributing the nitrogenous bacteria necessary to cause the roots of the plants to absorb the nitrogen from the air has been discovered, further benefit from these valuable plants may be expected.

THE SAND-PLAINS OF THE STATE.

HAVE THEY AN AGRICULTURAL VALUE?

(By The Director of Agriculture.)

The question has been freely put to the writer as to whether the great areas of sandy plains and rises which supervene at intervals between the stretches of richer soils throughout the State can be turned to profitable account for agricultural purposes. The State, from a climatic standpoint, is so peculiarly circumstanced owing to the long period of dry weather which characterises the summer months in our agricultural areas that the problem for the successful utilisation of this class of soil presents many difficulties. These, however, cannot be considered as insurmountable; and when we reflect upon what the profitable cultivation of these lands would mean to the State generally, it becomes manifest that our best efforts should be directed towards that end.

It would savour too much of the sanguine to lay down in this article any definite principle for

Cropping these Sandy Soils.

The ultimate success of turning them to commercial use must be approached by judicious experiment. With this object in view, the Director of Agriculture for this State seeks the co-operation of the farmers. With a view of opening a discussion relative to this very important matter, and to cause those interested in the agricultural, grazing, and dairying industries to seriously contemplate the question, some arguments are here introduced.

When the writer remembers seeing very heavy crops of wheat grown in sandy soils of no better quality than many of those under review, the idea of trying what can be done here at once exerts itself. It must be borne in mind, however, that the soils where these good crops were grown received a sufficient supply of moisture nearly all the year round. But notwithstanding the disability of having a long interval of dry weather in this State, scientific investigation has shown that it is quite possible to

Materially assist the Soil

in retaining a large measure of the moisture it receives during the rainy period, by a proper system of cultivation. Such being the case, we will discuss the main features which would probably lead to a successful cultivation of these sandy soils.

On many of these sandy plains and slight elevations there is a vegetation of a more or less stunted or vigorous character; and we have here an evidence that Nature has supplied certain elements of plant food to sustain this promiscuous growth. In many places this vegetation, dating back for countless years, has left in its habitat a certain quantity of humus, but its great root system has developed in the soil an acidity which can only be corrected by the liberal use of lime. Broadly speaking, it is obvious that

this vegetation must be cleared away, and its acidity checked in the manner stated, before any commercial grasses or plants can be substituted. The lime would necessarily decompose the root system; and then after cultivation, which is comparatively easy, and the use of fertilisers, the sandy soil may be considered to be in a condition to receive domestic plants. In

Clearing the Land

of its present indigenous growth, several points must be observed. The action of the wind has to be reckoned with during the dry time of the year; and this being so, it would be expedient to leave certain stretches of the land uncleared. The reason and utility of this is emphasised in noting the experiments of Professor King, of Wisconsin University. It was found that where there was a high wind velocity in the level districts, where the soil was light and sandy, with a small water capacity, and which were lacking in adhesive quality, the fields suffered greatly at times from the wind. There was a loss of moisture, and the soil was greatly damaged by drifting. Under such conditions, it is a matter of great importance that the wind velocities close to the surface should be reduced as much as possible.

The experiments regarding the action of the wind in these cases are very interesting. Wherever broad open fields lay unsheltered by any windbreak, the winds not only dry out the soil, but often sweep entirely away crops of grain after they are 4in. high, uncovering the roots by the removal of one to three inches of the surface soil. It has been discovered, however, that wherever there are windbreaks of any kind—even such slight barriers as fences, and even fields of grass—a marked protection against drifting has been experienced for several hundred feet to the leeward of them.

Probably not one farmer in one hundred has ever thought of the

Extraordinary Protection

that groves, hedgerows, and fields of grass give to his cultivated paddocks. This protection results partly from the tendency of these windbreaks to render the air which passes over them more moist, and partly by lessening the surface velocity of the wind. Professor King observed that when the rate of evaporation at 20, 40, and 60 feet to the leeward of a belt of timber 15 to 20 feet high was 11·5 c.c., 11·6 c.c., and 11·9 c.c., respectively, from a wet surface of 27 square inches, it was 14·5, 14·2, and 14·7 c.c. at 280, 300, and 320 feet distant; or 24 per cent. greater at the three outer stations than at the nearer ones. So, too, a scanty hedgerow produced observed differences in the rate of evaporation as follows, during an interval of an hour:—

At 20ft. from the hedgerow the evaporation was 10·3 c.c.
At 150ft. from the hedgerow the evaporation was 12·5 c.c.
At 300ft. from the hedgerow the evaporation was 13·4 c.c.

From this it is seen that the drying effect of the wind at 300ft. was greater than at 150ft. from the hedge. Then again, when the wind came across a clover field the evaporation was 40 per cent greater at 300ft. than at 20ft., and 7·4 per cent. greater than at 150ft.

It is manifest that before we can do anything calculated to

Profitably utilise these Sand-plains,

we must work to a plan. A system of rotation of crops must be adopted, which, after all, is the most profitable method of husbandry; and care

must be taken to avoid broad continuous fields. The fields should be laid out with alternate lands of grass and cereals or other crops. This method would also compel the farmer to rest and husband his pastures, because he could not very well turn on his stock while his other crops were growing beside the grass plots. Again, the surface of sandy soils, until the root system of the exotic grasses can form a consolidation, would not bear the tramp of stock. Hence it would be necessary to adopt more intensive husbandry, and grow what is termed soiling crops of grass until experience showed that the carrying capacity of the surface permitted stock to be depastured on it.

Some Interesting Experiments

are recorded regarding rolling and the retention of soil moisture; and as some farmers may be disposed to use the roller too freely on the lighter soils, a few remarks concerning it may be permissible here. In the experiments conducted by Professor King, and recorded in his work "Irrigation and Drainage," it is shown that when the surface of a field is finished with a heavy roller, it is left in a condition in which its moisture will be rapidly lost. Firming the surface re-establishes the capillary connection with the soil below, and the moisture is brought to the surface quickly from depths as great as four feet. The appearance to the eye is that the ground is made more moist by this operation, and so it is at the surface, but it is at the expense of moisture stored deep in the ground. Rolling leaves the surface smooth and even, so that it absorbs heat rapidly from the sun on a clear day, and becomes warmer below the surface than ground not rolled. This hastens the rate of evaporation from the surface. Then, too, this smooth surface allows the wind velocity to be much greater close to the ground, and on this account the loss of water is increased.

It may be often desirable to use the heavy roller in

Fitting Ground for Seed,

and sometimes for the express purpose of bringing an increased amount of moisture to the seed, in order to hasten or to insure germination when the soil has become dry. But when this has been found desirable, the roller should immediately be followed with a light harrow, in order to restore a thin mulch, which shall check the loss by evaporation from the surface without at the same time preventing the rise of the water from below to moisten the soil about the seed.

While the sandy soils are porous the rains would not have the same tendency to cause the soil granules to coalesce and destroy the effectiveness of the soil mulch, but a word or two of advice on the efficacy of maintaining

A proper Soil Mulch

generally on all soils may be well given here. The maintenance of moisture in the soil is of paramount importance. It is often desirable, Professor King has discovered, to repeat the cultivation or harrowing as often as there has been a shower of sufficient intensity to establish good capillary connection between the stirred soil and unstirred soil. It is of the greatest importance that this re-establishing of the mulch should take place at the earliest possible moment, not only because of the rapid loss of water from wet surface, but because of the fact that, when the surface soil has reached a certain degree of dryness, while the deeper soil is yet wet, the moisture of

the surface layer so strengthens the upward movement of soil moisture into that layer that not only is all of the rain held at the surface, but a considerable amount of the deeper soil water is brought there also. "Our studies have proved, both by observation and by repeated experiment, that wetting the surface of the ground may leave the deeper soil actually dryer than it was before, and if the new mulch is not early developed, the rain may leave the surface four feet dryer than it would have been had the rain not occurred."

It will be seen that there is a very practical lesson to be learned from studies and experiments of this kind; and experience has frequently shown that the farmer with an intelligent conception of the principle of retaining soil moisture by judicious cultivation has been rewarded with an increased yield of wheat of from five to ten bushels per acre. In subsequent articles the writer may have something further to say on these momentous problems.

AUSTRALIAN HORSE TRADE.

INDIA'S REQUIREMENTS.

The Director of Agriculture (Mr. Chaplin) has been handed a copy of the following letter from Colonel Goad, the Director-General of the Army Remount Department, India, which was forwarded to the Premier of this State by the Prime Minister of the Commonwealth. The Prime Minister states that his Government considers Colonel Goad's remarks worthy of very serious attention:—

"April 8, 1905.

"The Government of India, through the Director-General of Remounts, takes from two to three thousand horses annually for Army purposes (last year four thousand), at £45 per head, landed and approved in India. The horses brought over for this purpose are nearly all unbroken.

"These horses are mainly horse and field artillery class, with more or less cavalry from time to time. These artillery classes are the pick of the horses of that type bred in Australia, and, unfortunately, the class is decreasing rapidly.

"I would not have bothered you with this subject were the matter not entering into an acute stage, but horses of the class required are now so scarce that they realise prices at which our shippers will not be able to continue the trade, and I have this season had to import horses for army purposes from North America, Argentine, and Hungary, in order to see how these horses do in India, and thus be able to turn elsewhere at once for remounts should Australia fail us. It would be a matter of the deepest regret should I have to do so, for, as we stand, I believe that no other army

in the world is horsed as well as His Majesty's Army in India is with our Australian horses, and I sincerely trust that the supply may continue. I have talked the matter over with Mr. Campbell, Director of Agriculture for New South Wales, and with Mr. Swinburne, Minister for Agriculture in Victoria, and they both agree that some step should be taken immediately to mend matters. I trust, however, that the subject may receive your assistance, for whatever is done should be done quickly, or the trade will be lost to Australia.

"As regards the decrease of the class of horse we require, this is in no way owing to the purchases of horses made for South Africa, Germany, and Japan, as these horses were of a very different standard; so much so, that when the War Office proposed, when returning British cavalry regiments to India (sent from India to South Africa ready horsed), to send them with the horses on which, during the process of time, they had been remounted in South Africa, this offer was, on my representation as to the inferior class of horse we should receive, refused by the Indian Government.

"In addition to the Government trade, large numbers of superior horses are annually shipped from Australia for the private market in India.

"The difficulty now experienced in obtaining the class of horse we require for the Army in India is, I believe (and I have made very careful inquiry into the matter), mainly due to the facts:—(1) That many inferior stallions are being used; and (2) that owners have sold many of their best mares for export. The remedy, if I may be allowed to offer an opinion:—(1) A tax on all stallions, none being allowed to cover unless passed by a duly qualified official appointed to inspect them; (2) in Government providing really good stallions, thoroughbreds, Clydesdales, Suffolks, and Welsh ponies for use by breeders at a nominal fee. This system obtains in all the great horse-breeding countries in Europe (I, personally, have had the advantage of visiting these countries for the Government of India, and studying the systems in force); or (3) in giving premiums to private individuals (as is done on a very small scale in England) who will stand approved stallions at a nominal fee for the use of breeders; (4) steps should be taken to prevent the best mares leaving the country.

"With regard to 2 and 3, it may be thought that 2 might interfere with private interprise. Should this be so, then 3 would meet the case, should sufficient private owners be willing to take the matter up on the local Government calling for offers to do so; but I would strongly urge that, whatever is done, be done without delay. It must also be remembered that, in either case, the whole success of the matter depends on thoroughly suitable men being chosen to approve or buy stallions; and stallion-keepers should have sufficient experience to advise small breeders who own two or three mares which class of stallion to put to their mares. Australia has a record second to no country in the world for breeding good horses of every class, and the trade with India in such horses brings a certain amount of money into the country (mainly to Victoria, New South Wales, and Queensland). For remounts alone this season £180,000 (£45 × 4,000) has been paid by my department for Australian horses. In addition to this, it must be remembered that a large amount of money, labour, etc., is employed for forage, grain, shipping, etc., for the large number of horses now exported from Australia, and it would be a million pities that this should go elsewhere.—(Sgd.) Howard Goad, Colonel, Director-General Army Remount Department, India."

PROPOSED BORING FOR ARTESIAN WATER IN THE EASTERN AGRICULTURAL DISTRICTS.

By A. GIBB MAITLAND, Government Geologist.

In the early months of the year, instructions were issued for an examination of the Eastern Agricultural Districts, with the view of furnishing a report upon the possibilities of an overflowing supply of water being obtained by boring operations.

It was not, however, until the middle of July that the exigencies of the Department admitted of me leaving Perth for this work. I was engaged upon this duty until the end of November (with the exception of three short intervals, when I had to return to head-quarters on official business), and about three weeks, which were devoted to the geology of the neighbourhood of Cape Riche with reference to the probability of the occurrence of coal between the Pallinup River and Albany.

Work was commenced at Brunswick. From Brunswick I travelled *via* Donnybrook and the head waters of the Preston to Bridgetown; thence *via* Balbarup, Lake Muir, and Forrest Hill to Mount Barker; thence *via* Millinup and Northwards across the Kalgan River to the Stirling Range; thence down the Pallinup River to Cheyne's Bay on the South coast; thence *via* Warriup to Albany; thence Northwards to Broome Hill; from Broome Hill *via* Katanning, Kojonup, and the Beaufort River to Wagin; thence *via* the Arthur, Williams, and Bannister to Narrogin; from Narrogin *via* the agricultural areas of Wickepin and Mourambine to Beverley; thence to York and Northam; thence *via* Goomalling to the Wongan Hills and Moora on the Midland Railway line.

Before describing in detail the country traversed, it may not be out of place to quote a brief statement as to the requisite geological conditions of artesian wells, as there seems to be much misconception on this point:—

Artesian water is that portion of rain water which has reached (whether directly or not) the outcrops of porous beds, and has followed the sloping course of the beds downwards between other strata sufficiently impermeable to imprison the water until it finds, at a lower level than the source, a natural or an artificial opening, through which, by the force of gravity, it issues at the surface. When it issues from a natural spring it is called "Spring Water;" and, generally stated, artesian water is from a different source than that obtained from "Surface Wells" which derives their supplies from shallower strata, such as sands, gravel, and other porous beds that are surcharged with water, the permanency of which is immediately dependent on rainfall; hence the supply of water from surface wells oscillates with the seasons. It often becomes much reduced or fails altogether in dry weather or when it is largely drawn upon.

The fundamental principles of "Artesian Wells" are simple and easily understood, but they are not infrequently associated with complicated problems. Briefly and generally, the principles may be summarised as follows:—

(I.) There must exist between the "outcrop" and the well at least one continuous stratum sufficiently porous to permit the easy flow of water through it, and this stratum must be sandwiched between two impermeable beds thick enough to confine the water. The impermeable beds must be quite free from any defect that would permit the escape of water at some lower

level than the mouth of the well in such quantity as would be inimical to a steady flow therefrom. The perfect condition of the upper confining beds is of much more importance than an unblemished condition of the lower confining beds, as it is likely the water, in its downward course, would meet the same stratum that would arrest its further progress.

(2.) That the outcrop of the porous stratum exposed to saturation must be porous enough to readily admit the entrance of water, and its area must be ample for keeping the porous stratum always charged with water to the degree necessary for a copious flow, equal, at least, to all reasonable demands made on the well.

(3.) That the altitude of the outcrop must be high enough above the mouth of the well, so that the pressure due to the difference of level between them, after providing for frictional resistance to the flow of the water in the porous stratum, be sufficient to cause the water to rise in the well and flow at the surface. Frictional resistance is by no means inconsiderable if a long distance intervenes between the outcrop and the well; its co-efficient depends chiefly upon the degree of porosity of the water-bearing beds; hence its measurement is impracticable, and consequently it is always an unknown quantity.

(4.) That the rainfall in the region of the outcrop must be ample and that the portion which enters the porous bed will be quite sufficient to ensure a steady and abundant supply of water to the well.

And unless these conditions are present in a favourable degree, satisfactory results cannot be expected to follow a search for artesian water. But there is another factor which, if not necessary for the presence of artesian water, is nevertheless important, notwithstanding the depth from which such supplies are obtained; and that is, the region supplying the porous beds should be perfectly free from anything that would be hurtful to the purity of the water.*

What may be called the coastal plain, between the Brunswick River and the Lower Preston, has already been proved to be country favourable to the occurrence of artesian water, hence no reference need be made to it in this place.

The road from Brunswick to Donnybrook, *via* Boyanup, is over fairly level country, devoid of interest, as no sections of the underlying rock are visible anywhere. The country, however, may be, and in all probability is, underlaid by sandstones and shales of the Collie River type. The impermeable crystalline rocks, however, appear in great force on the high ground to the East, and their outcrop forms a sinuous line, commencing a little to the East of the Brunswick Railway Station, and crosses the Collie River some miles below what is known as Shenton's Elbow, thence across the Ferguson River.

From Boyanup to Donnybrook the track has been carried over a ferruginous conglomerate, which forms such a conspicuous feature in the geological structure of portions of the Colony, and which effectually conceals the underlying rocks.

It was, however, only in the vicinity of Donnybrook that I observed the underlaying rocks emerge beneath this mantle of conglomerate.

DONNYBROOK.

The hilly country to the North of the township exposes granite, gneiss (foliated granite?), hornblende-schist, micaceous quartz-schists, and quartzites, either vertical or nearly so, and trending generally North and South. These beds are associated with quartz veins of a sugary white

* R. L. Jack. Artesian Wells. Appendix E. Report of the Hydraulic Engineer on Water Supply. Brisbane: By Authority, 1893, p. 11.

appearance. To the Southwards the country drained by the upper reaches of the Capel River exposes an area of micaceous and hornblendic granite, intersected by a dyke of some basic igenous rock, trending North and South, and which can be followed for some distance to the North and South. Between Donnybrook and the head of the Preston River, the country consists of coarse muscovite gneiss, banded quartzite, and hornblende-schist, which latter may be merely transmuted diorite. At the North-West corner of $\frac{48}{681}$ the strike of the gneiss is North 30° West. In parts of the Preston the lower ground, in addition to a more or less expansive width of alluvium, is covered with residuary ironstone gravels. Granitic and gneissic rocks prevailed nearly as far as Frank's Well, Reserve 1241, when these beds are concealed by a covering, which cannot, however, be very great, of sand (disintegrated sandstone ?) and conglomerate of a somewhat similar character to the beds of the Collie River. From this point to the site of the 5th camp, about five miles East of Yennungboonarrie, in Reserve 681A, the country is overlaid by sand with one or two exposures of sandstone, to the disintegration of which the sands may, in all probability, be ascribed.

Bridgetown.

The staple formation in the neighbourhood of Bridgetown, on the North, consists of vertical beds of granitic gneiss trending generally North and South, and intersected by dykes of some basic igneous rock, probably diorite. In some portions of the district these schistose rocks are invaded by what seems to be a very fine-grained granite. The summit of the higher ground is covered with a ferruginous conglomerate of the type prevalent in the district, but of no great thickness. To the East of Bridgetown a band of gneissic rocks occupies the country for some considerable distance, and its place taken by granite of the prevailing type. The section down the river from Winnejup exposes granite and diorite, overlaid in places by a thin mantle of ferruginous conglomerate.

Nowhere in the vicinity of Bridgetown do the conditions requisite for obtaining an overflowing supply of water occur, hence no artesian water is likely to be obtained.

From Bridgetown I travelled *via* the Donelly River, and down the Wilgarrup River as far as Balbarup. Sections at intervals along the road, more in the immediate vicinity of Bridgetown, showed the staple formation to consist of granitic rocks, invaded by basic dykes, overlaid in places with a comparatively thin covering of ferruginous conglomerate.

Between Balbarup and the crossing of the Perup River, at Reserve 805, no section of the strata is visible; on the West bank of the river, near the bridge, the granitic rocks again make their appearance, and occupy the country for some little distance.

From Perup down the river to Topanup or Deeside, just about two miles above the junction of the Tone and the Perup Rivers, the crystalline rocks do not outcrop, at any rate in the vicinity of the track, but occur in great force at Deeside.

From Deeside to Merrilup Bridge, which has been thrown over the Tone River, on Reserve 804, no rocks make their appearance.

The country between the Tone and the Frankland Rivers is very sandy and swampy, with a few exposures of conglomerate at very irregular intervals.

MOUNT HARDY.

General view of F. W. Cook's Selection. Holding, 280 acres; 55 acres cultivated; all fenced.

A tributary of the Frankland, flowing from the East, enters the river some distance above Muir's Bridge, on Reserve 1916. Decomposed granite emerges from beneath the conglomerate at Traverse Station L 3, alongside the road.

Between the head of this creek and the Denmark River, the road has been carried over ferruginous conglomerate of the prevailing type. No strata are exposed between Denmark and Perillup, but a change in the character of the timber marks a change in the nature of the underlying rocks.

The country drained by the heads of the Hay River, in the vicinity of Mount Barker, is composed of crystalline rocks, which trend generally East and West, and dip to the South at high angles; no artesian water is likely to be obtained in that locality.

A description of the geology of the country between Mount Barker and Cape Riche is given on a later page.*

Broome Hill.

The township of Broome Hill is situated in the country drained by the heads of the Gordon River, at an attitude of 1,073 feet above sea level.

The country is composed of granitic rocks associated with dykes of some basic rock, which latter have a general strike of West-North-West. It is to the decomposition of these basic rocks that the fertility of the soil is due. No artesian water is likely to be obtained in country of this nature.

Katanning.

The road following the railway from Broome Hill to Katanning does not expose any of the underlying rocks; but, at Katanning itself, a well near the South-West boundary of the townsite shows that granite is the staple formation. The country to the North-East of the town, within the limits of the proclaimed agricultural area, is of granite also; this is overlaid by a quasi-vitreous ferruginous sandstone, seen on the surveyed road between Locations 205 and 83. The bed, which occupies the highest portion of the road, is not very extensive, nor does it attain any great thickness. The country to the East of Katanning is of the same formation. In consequence of the geological character of the country, no artesian water can be expected.

Kojonup.

The road from Katanning to Kojonup crosses Carlecatup Creek, one of the heads of the Carrolup River. About a mile below the crossing of the road is a conspicuous residual boss of granite, shown on the maps as Yeedabirrup Rock. The township and vicinity of Kojonup is of granite, intersected by dykes of pegmatite and diorite.

No artesian water is likely to be obtained in the vicinity.

Granitic rocks occupy the country between Kojonup and the Beaufort River, in the vicinity of the Perth-Albany Road. They are covered with ferruginous conglomerate in the vicinity of Wagin.

* Page 29. Annual Report, 1898, Geological Department.

Wagin.

Granite, intersected by diorite, occupies the country in the township and its vicinity. Wagin is situated at an altidude of 840 feet above sea level, and forms the summit of a comparatively lofty table-land. The country to the East of Wagin, as far as Goondaring Lake, is also of granite of the prevailing type.

The country, drained by the heads of the Arthur and the Williams, is of granite, associated with basic dykes, the latter of which have a general strike of West-North-West.

Narrogin.

The township of Narrogin lies at an altitude of 1,114 feet above sea level. The staple formation in the neighbourhood is granite, overlaid by ferruginous conglomerate. The proclaimed agricultural area of Narrogin is of a similar geological constitution. Such conditions prevailing, no artesian water need be anticipated.

From Narrogin to Wardering Spring, at one of the heads of the Hotham River, similar rocks prevail.

Wickepin Agricultural Area.

Mungerung Cutting Well, on Reserve 2175, lies at an altitude of about 450 feet above Narrogin. The proclaimed area is of granite, intersected by dykes of diorite, the whole being overlaid by a thin covering of ferruginous conglomerate. Between Wickepin and Moorumbine similar country prevails, as also the country between the heads of the Hotham and the Avon Rivers.

Beverley.

The vicinity of Beverley is of granite and associated rocks, with a width more or less great of alluvium on the banks of the Avon River. Six trial bores have been put down in the more immediate neighbourhood of the town, the deepest reaching only 38 feet from the surface. I have had no opportunity of examining the material penetrated, but the following particulars have been taken from the records of the Works Department:—

No. 1 Bore, situated on Subsection 23, just to the West of Beverley Pool, in the bed of the Avon River, showed the following section:—

Nature of Strata.	Thickness.	Depth.	Remarks.
	feet.	feet.	
Sand	1		Fresh water was struck in this bore at a depth of 19 feet, and rose to within 18 feet from the surface.
Clay	3	1	
Sandstone	5	4	
Sand	2	9	
Clay	4	11	
Sand	6	15	
Total	21	21	

No. 2 Bore, on Reserve 3586, on the Eastern bank of the Avon, and in the South of Vincent Street, penetrated to a depth of 22ft., and showed the following section :—

Nature of Strata.	Thickness.	Depth.	Remarks.
	feet.	feet.	
Sand	2		A supply of brackish water was met with at 20 feet, and rose to a depth of 19 feet below the surface.
Sandstone	12	2	
Sand	8	14	
Total	22	22	

No. 3 bore, on Subsection 137, in Vincent Street, was carried down to a vertical depth of 27 feet. The strata pierced were as follow :—

Nature of Strata.	Thickness.	Depth.	Remarks.
	feet.	feet.	
Sand	3		Brackish water, which rose to 15 feet from the surface was struck at a depth of 27 feet.
Clay	5	3	
Hard sandstone	15	8	
Sandstone	3	23	
Sand	1	26	
Total	27	27	

Bore No. 4, to the East of Reserve 1744, near the junction of Forrest and John Streets, reached 38 feet vertically below the surface. The sinking showed the following section :—

Nature of Strata.	Thickness.	Depth.	Remarks
	feet.	feet.	
Sandstone	16		A supply of brackish water was struck at 38 feet, and rose to 25 feet from the surface.
Clay	22	16	
Total	38	38	

Bore No. 5, in Vincent Street, about a mile from the bridge over the river, was 31 feet in depth, and ended in granite. The following is the section of the rocks passed through :—

Nature of Strata.	Thickness.	Depth.	Remarks.
	feet.	feet.	
Clay	1		No water struck in this bore.
Sandstone	8	1	
Clay	6	9	
Sandstone	16	15	
Granite			
Total	31	31	

No. 6 Bore, in Vincent Street, a few chains West from No. 6, was carried down 30 feet vertically below the surface. The sinking showed the following section:—

Nature of Strata.	Thickness.	Depth.	Remarks.
	feet.	feet.	Fresh water was met with at 25 feet, and remained stationary at 25 feet from the surface.
Sand	2		
Clay	28	2	
Total	30	30	

No artesian water is likely to be obtained in the vicinity of Beverley.

York.

The neighbourhood of York is of granite and schistose rocks, intersected by dykes of diorite; in addition to which are extensive alluvial deposits on the bank of the Avon River.

Five bores have been put down in the search for water in the vicinity, the deepest of which attained a depth of nearly 130 feet.

The following particulars in connection with them have been taken from the records of the Department of Public Works.

Bore No. 1, situated near the junction of Pool Street and Avon Terrace, was 80 feet in depth. The section is as follows:—

Nature of Strata.	Thickness.	Depth.	Remarks.
	feet	feet	
Clay	2		A supply of fresh water was struck at 19 feet, and rose to 17 feet below the surface. Brackish water was struck beneath the ironstone gravel, and rose to 13 feet from the surface.
Sandstone	9	2	
Clay	8	11	
Drift	1	19	
Ironstone gravel	60	20	
Granite			
Total	80	80	

Bore No. 2, near the junction of North and Georgiana Streets, was carried down 124 feet below the surface, through the following rocks:—

Nature of Strata.	Thickness.	Depth.	Remarks.
	feet	feet	
Clay	6		No water.
Hard sandstone	67	6	
Hard red clay	32	73	
Clay	1	105	
Drift	12	106	
Rock—undetermined ...	5	118	
Granite	1	123	
Total	124	124	

NORTHAM.

The country between York and Northam is of granitic rocks. Exigencies of travel necessitated journeying *viâ* Quellington and Grass Valley. Granite forms the staple formation, as seen on Reserve 2963 and the Quellington School Reserve. Schistose rocks make their appearance at intervals between this place and Grass Valley. Granite occupies the country near Reserve 2602 at Grass Valley.

Northam itself is situated in a region of granitic rocks, which are intersected by dykes of some basic igneous rock. There are somewhat extensive alluvial flats in the vicinity.

The country to the south of Northam, in the vicinity of Barralong Pool, is of granitic schist, which is either vertical or inclined at high angles; the general trend of the schists is north-east and south-west. At Spencer's Brook their place is taken by fine-grained granite, the relations of which to the schistose rocks could not be determined.

Thirteen bores have been put down in the vicinity of Northam, the particulars in connection with these (which have been extracted from the records of the Public Works Department) are as follows:—

No. 1 bore, on Reserve 13294, Duke Street, was carried down 8ft. below the surface.

Nature of Strata.	Thickness.	Depth.	Remarks.
	ft.	ft.	
Sand	2	...	This bore was apparently unsuccessful.
Clay	2	2	
Sandstone	4	4	
Rock—undetermined ...			
Total	8	8	
	...	...	

No. 2 bore, on the same Reserve as No. 1, and adjoining, showed the following:—

Nature of Strata.	Thickness.	Depth.	Remarks.
	ft.	ft.	
Sand	2	...	No water was obtained from this bore.
Clay	2	2	
Sandstone	3	4	
Rock—undetermined ...			
Total	7	7	
	...	...	

No. 3 bore adjoins No. 2, on the same property. Boring showed the following section:—

Nature of Strata.	Thickness.	Depth.	Remarks.
	ft.	ft.	
Sand	2	...	A supply of brackish water was struck at 16 feet.
Clay	2	2	
Boulders	4	4	
Clay	1	8	
Sandstone	6	9	
Gravel	1	15	
Granite			
Total	16	16	
	...	...	

No. 4 bore, on Lot 3, Subdivision N, York Road, to the east of the junction of the Mortlock and the Avon Rivers, was carried down to a depth of 21 feet through the following strata:—

Nature of Strata.	Thickness.	Depth.	Remarks.
	ft.	ft.	
Clay	16	...	Fresh water was met with at the bottom, and rose to 12 feet from the surface.
Drift	5	16	
Total	21	21	
	...	...	

No. 5 bore adjoins No. 4, and showed a similar section:—

Nature of Strata.	Thickness.	Depth.	Remarks.
	ft.	ft.	
Clay	16	...	A supply of fresh water was struck at the bottom, and rose to 12 feet from the surface.
Drift	4	16	
Total	20	20	

No. 6 bore, on Lot 20, Fitzgerald Terrace, penetrated the following:—

Nature of Strata.	Thickness.	Depth.	Remarks.
	ft.	ft.	
Clay	16	...	Fresh water, which rose to 12 feet from the surface, was struck beneath the sand.
Sand	5	16	
Total	21	21	

No. 7 bore, in a nameless road which connects Mace Street with Barralong Road, and to the west of Morrell Street, was carried down to a depth of 68 feet through the following rocks:—

Nature of Strata.	Thickness.	Depth.	Remarks.
	ft.	ft.	
Sand	3	...	Salt water at 22 feet, which was temporarily shut off.
Sandstone	3	3	
Clay	9	6	
Drift	7	15	Brackish water at 33 feet from the boulder bed, also shut off.
Clay	11	22	
Boulders	5	33	
Gravel	6	38	A supply of fresh water was met with in the sandstone at 57 feet, which rose to 16 feet from the surface.
Clay	3	44	
Drift	10	47	
Sandstone	9	57	
Gravel	2	66	
Granite	...	...	
Total	68	68	

No. 8 bore, at the north-west corner of Lot 69, Burgoyne-street, was carried down 12 feet through the following:—

Nature of Strata.	Thickness.	Depth.	Remarks.
	ft.	ft.	
Clay	2	...	No water was met with in this bore.
Rock—undetermined ...	10	2	
Granite	...	...	
Total	12	12	
	...	...	

No. 9 bore, near the northern corner of the Jubilee Recreation Ground, Lot 217, Peel Terrace, penetrated the following:—

Nature of Strata.	Thickness	Depth.	Remarks.
	ft.	ft.	
Clay	6	..	Salt water stands 11 feet below the surface in the bore.
Gravel	3	6	
Sand	5	9	
Sandstone	3	14	
Granite	...	...	
Total	17	17	

No. 10 bore, near the eastern angle of the last-mentioned reserve, near the junction of Henry Street and Peel Terrace, was carried down 37 feet through the rocks mentioned below:—

Nature of Strata.	Thickness.	Depth.	Remarks.
	ft.	ft.	A supply of salt water was obtained from the drift at 17 feet, and a further supply from the drift at 27 feet. Brackish water was struck at the bottom of the bore hole, which rose to 12 feet from the surface.
Dark clay	10	...	
Red clay	7	10	
Drift	2	17	
Sandstone	8	19	
Drift	2	27	
Pipe-clay	8	29	
Granite	...	...	
Total	37	37	

No. 11 bore, near the corner of Ord and Fitzgerald Streets, was carried down to a vertical depth of 111ft. through the following:—

Nature of Strata.	Thickness.		Depth.		Remarks.
	ft.	in.	ft.	in.	
Clay	2	0	...		A supply of brackish water was struck at 31 feet 9 inches, a second at 47 feet, and a third at 65 feet. At 94 feet fresh water was met with; it rose to 14 feet above the surface.
Sandstone	29	9	2	0	
Pipe-clay	20	0	31	9	
Red clay	14	0	51	9	
Hard clay	24	3	65	9	
Sandstone	10	0	90	0	
Red clay	7	0	100	0	
Drift	3	0	107	0	
Rock—undetermined ...	1	0	110	0	
Granite	...		...		
Total	111	0	111	0	

No. 12 bore, on part of Location P.1w, Chidlow, pierced the following:—

Nature of Strata.	Thickness.	Depth.	Remarks.
	ft.	ft.	This bore yielded no water.
Brown clay	2	...	
Red clay	10	2	
Sandstone	4	12	
Granite	...	...	
Total	16	16	

No. 13 bore, on the same ground as No. 12, but a little distance to the south, gave the following section:—

Nature of Strata.	Thickness.	Depth.	Remarks.
	ft.	ft.	
Brown clay	2	...	Brackish water met with at 15 feet below the surface of the ground.
Red clay	12	2	
Sandstone	6	14	
Granite	...	...	
Total	20	20	

Goomalling.

From Northam, I examined the country drained by the heads of the north branch of the Mortlock River, and in the vicinity of the proposed Northam-Goomalling Railway line, with a view to the possibility of artesian water.

The whole of the rocks in the vicinity are crystalline schists, which are absolutely impermeable below the zone of decomposition, which, in this district, does not appear to be very great.

Along the Irishtown Road, in Location 1046, is a conspicuous hill, upon the flanks of which an exceedingly ferruginous schist outcrops. Vertical mica schists, trending north-west and south-east, make their appearance between this hill and the main road. Dark basic rocks are exposed in the vicinity; their exact relation to the schists is not readily apparent though they would seem to be in the form of dykes.

Further north, about two miles higher up the Mortlock, and crossing the road between Locations 1765 and 1058, is a similar iron-bearing schist, trending north-north-west.

A recently cleared paddock in the vicinity of the Jenapullin Agricultural Hall, and a little to the north of it, exposes a very dark hornblendic rock. The nature of this rock is not readily apparent, some portions of it, however, have a rude schistose habit, whilst others contain porphyritic hornblende crystals.

Location 54/52 encloses two conspicuous isolated hills, which are composed of hematite-bearing schist, some portions being exceptionally rich in hematite. The strike of these beds, so far as can be judged, seems to be north and south.

A conspicuous rise on the Northam Road, just south of 48/720, is a bold outcrop of hematite-bearing quartz schist, dipping at a comparatively low angle to the north-east; as exposed to the surface, its width is about 20ft. The outcrop can be followed by the eye for considerable distances both north-west and south-east.

So far as observations have been at present carried, this band or horizon of iron-bearing schists is about 6 miles in width; it is, however, not at all improbable but that this great width may be in some measure due to a reduplication of the outcrops by folding.

Cartamulligan (? Carter Mulligan) Rock, on Reserve 737, marks, approximately, the junction between the iron-bearing schists and the granitic gneisses; here the latter make their appearance in great force; the beds are vertical and trend north-north-west and south-south-east.

A barren-looking quartz reef, trending east and west, associated with the gneissic rocks, makes its appearance near the north-east corner of Location 48/1499. Northwards granitic rocks are exposed on Location 57/549.

The country in the vicinity of Blimmining Well, on Location 1687, is composed of granitic gneiss and mica schist, intersected by diorite dykes.

In Location 1687 is a bold vertical quartz reef, which can be followed north and south for some distance. A few yards to the east of the reef are three wells, each yielding, at the date of my visit, a copious supply of fairly good water; in all probability the reef acted as an impermeable barrier, and served to dam back the water. What is probably the continuation of the Blimmining Well reef occurs just west of Location 48/224, and about one-and-a-half miles due south of the locality first described. The reef, which has a barren-looking appearance, is apparently vertical, and forms the summit of a conspicuous sugar-loaf hill. The rocks in the vicinity are gneiss, and in the neighbourhood of the reef quartz seems to have been injected along the foliation planes.

Near the terminus of the proposed railway, on Reserve 1562, mica schist, trending north and south, prevails.

Nowhere in the vicinity of Goomalling, nor anywhere in the country traversed by the surveyed railway line, is any artesian water to be obtained.

Summary.

The strata underlying the what may, for convenience, be termed the Eastern Agricultural Districts, is of such a geological constitution as to be absolutely impervious to water below the zone of decomposition, and no amount of perseverance will secure an overflowing supply.

The wells put down at Beverley, York, and Northam, have derived their supplies from those superficial deposits, which are surcharged with water, and which cover an extensive area of country. The supply yielded by these wells is directly dependent upon the saturation of the ground immediately surrounding them, and is in no sense artesian.

There are certain sand plains in the district, too small, however, to be shown on the map, in which supplies of water may be obtained, but such would not be expected to rise above the surface.

The Artesian Water Prospects of the Vicinity of Moora.

The possibility of obtaining a supply of artesian water having received the attention of the residents of Moora, I received instructions to visit the neighbourhood and report upon the question.

In considering this question I found it necessary to give attention to the geological structure of the district, and to make traverses for some miles due west of the railway line, and to endeavour to add to the information acquired by the previous geologists who have examined and reported upon the country.

Moora township is about 600 feet, by the railway survey, above sea level, and is situated on what may be called the Great Coastal Plain, which forms a fringe, as it were, from north to south.

No section of the underlying rocks is exposed anywhere in close proximity to the township.

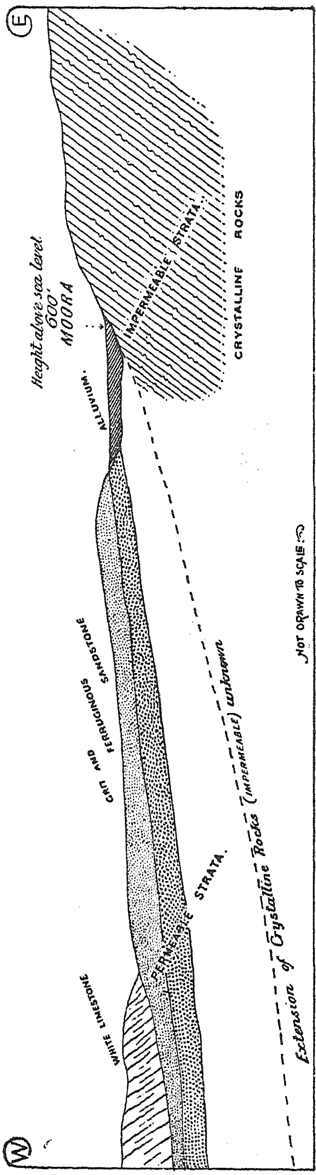
About a mile and a quarter due east of Moora Railway Station a low range of massive quartzite rises from the flats and forms a portion of the western escarpment of the tableland drained by the heads of the Moora River. The quartzites are, in places, finely banded, and in others brecciated; neither dip not strike can be made out. These quartzite beds are absolutely incapable of absorbing and transmitting water. Equally impermeable strata (granite and other crystalline rocks intersected by diorite and covered with ferruginous conglomerate) occupy the country between Moora and the Geraldton Road at Walebing.

The geological structure of the country between Moora and the coast, as can be seen by an inspection of the following sketch section, is simple in the extreme.

A traverse from Moora towards Dandarragan shows the staple formation to consist of a very ferruginous grit, lying apparently almost horizontally on the underlying rocks, which, from the character of the soil, would seem to be composed of similar rocks to those outcropping on the high land to the east. A fairly heavy sand plain extends from Location 30 as far as Location 430, the formation of which being in all probability due to the decomposition *in situ* of grits or sandstones. At Dandarragan the place of this is taken by white limestone, which produces a fairly rich black soil. The exact relation of the limestone is not quite clear, but the impression left on my mind is that it is newer than the grits and sandstones to the east. So far as can be ascertained, these strata are horizontal or nearly so, and the effect of this is shown by the fact that the individual rocks do not crop out on the flanks of the high ground to the east of Moora, but rest directly against the subterranean continuation thereof; in this respect the structure of the area is identical with that of the artesian water area of the vicinity of Perth.

A very noticeable feature in the physical aspect of the country, which may have an important bearing upon the question of underground water supply due west of Moora, is the course followed by the Moore River from

its source to the sea. In the course of the river there occur two well marked bends; the first change, after flowing in a generally westerly direction, occurs near Moora, where the course of the river alters somewhat abruptly,



GEOLOGICAL SKETCH SECTION TO ACCOMPANY REPORT ON ARTESIAN WATER AT MOORA, BY A. GIBB MAITLAND. GOVERNMENT GEOLOGIST.

and flows southward for about twenty-five miles, until it is joined by an important tributary flowing from near New Norcia. At this point the river makes a right angle and, sweeping round the southern extension of the

Gardiner Range, flows generally west for about thirty-five miles. Here the course gradually changes to the south, which general trend the river maintains for about twenty miles, and after being deflected to the west it retains that course, with many bends of more or less importance, until the Moore River enters the sea.

As pointed out above, the river, from its source to Moora, drains country formed of granitic and other equally impermeable crystalline rocks, and it is by no means improbable that the rocks underlying the elevated tract to the west of Moora (the Gardiner Range), which have been the means of such a marked deflection in the course of the river, may be a continuation of those outcropping on the flanks of the Darling Range. In which case, of course, no underground water could be expected after the strata of the tableland had been pierced.

The catchment area of the Moore River basin in the neighbourhood is along the flanks of the Darling Range; this, which rises to comparatively considerable elevations above the sea, sends all its drainage westward, conveying the rainfall directly to the porous beds of the coastal plain. This series of beds in the area under consideration has been so denuded along the junction of the two formations as to form what may be best described as a huge ditch along the valley of the Moore River, which aids in conveying to and keeping the water in the porous strata.

Evaporation and run-off (or discharge) are potent factors in the consideration of the subterranean water supply of a district; for it is the balance of the rainfall left, after these two factors are eliminated, which is available for absorption by the strata upon which it falls.

Records of rainfall are obtainable at four observing stations within the Moora neighbourhood, for a period varying from eight to 15 years, and at three others for very much shorter periods.

At Walebing, for 11 years previous to 1896, the average rainfall was 18·35 inches; while during 1896 it amounted to 16·23 inches. Yatheroo, however, has a higher average precipitation; for 10 years previous to 1896 the average rainfall reached 24·82 inches; and during 1896 the observe rainfall was 23·64 inches. New Norcia, for 14 years previous to 1896, averaged 19·27 inches, and during 1896 the records showed that 19·86 inches of rain fell. At Gingin, 322 feet above sea level, the rainfall for the seven years previous to 1896 averaged 26·01 inches, while during 1896 the meteorological observers recorded 26·52 inches. The rainfall observations at Dandarragan, Berkshire Valley, and Moora do not appear to have been carried over such an extensive period, and the data at my command are not quite so reliable.

For all practical purposes, however, the figures above quoted may be fairly considered as the rainfall for the drainage area of the Moore River basin. It would thus seem that the precipitation in the district is fairly considerable, and after allowing for evaporation and run-off, a good deal of the rainfall must disappear underground, and be capable of being reached by wells.

No observations as to the actual discharge of the Moore River would appear to have been made, so that no estimate of the amount of water absorbed by the rocks can be arrived at. The observations of those who have resided for many years in the district testify to the fact that all the

water which flows down the river does not reach the sea, or, in other words, there is a disappearance of the river water during its passage seawards.

Despite the fact that a portion of the rain which falls in the district percolates the loose incoherent strata, and, if resting on clayey or other impervious strata, may be reached by wells or bores, the situation of the town of Moora near the edge of the intake of the coastal plain strata reduces the chances of obtaining a copious supply of water under pressure and increases the chances of any such supply being of an intermittent character.

The search for underground water in the neighbourhood of Moora by means of deep wells has, however, not been undertaken, even though all the conditions necessary for a successful issue would seem to prevail.

POULTRY NOTES.

By Frank H. Robertson.

Farmers and others are reminded that the present is the best time of the year to make a start in poultry breeding, and as so many persons have of late taken up land for the purpose of making a living out of it, the raising of fowls, ducks, geese, or turkeys as a valuable by-product is sure to receive a considerable amount of attention. But as so many farmers' experience relates almost entirely to the production of wheat or chaff, the management of horses, and a fair idea of sheep, that they feel a good deal out of their depth when the subject of fowls crops up for discussion as a means of increasing the productiveness of the holding, so a few hints as to the best means of making a start on a sound basis may be acceptable. Keeping fowls for egg-production is in most instances the best paying form of poultry raising; in some cases turkeys pay best, and in others ducks are most profitable; it all depends on certain conditions. If there are thousands of acres available and no other holding near, turkeys pay remarkably well; they also do well on smaller areas, provided they receive adequate care and attention; and if the natural surroundings are favourable, duck-raising can be easily and profitably carried on, that is, in localities where there is plenty of water in which is to be found a good supply of the natural food of water-fowl, in the shape of succulent green fodder and animal life. Some localities are particularly suitable for all these, viz., fowls, ducks, and turkeys, in which case the owner contemplating poultry raising is fortunate. Then again there are other farms which are badly situated for the successful raising of fowls to any great extent unless considerable alterations are made; such a locality would be one where the fowl run is erected in a part of this State where the climate is very cold in winter, hot and dry in summer, hard soil, an absence of undergrowth for shade and shelter, also a scarcity of green-stuff and animal food. Poultry can be kept under such conditions, but they will not thrive well. To make such a locality fairly suitable breakwinds would have to be erected, and artificial shelters provided until creepers and

shady trees were grown, and the objections as to the deficiencies of animal food and green feed would have to be overcome by producing supplies of green chaff (lucerne preferred), growing pumpkins and summer-resisting vegetables such as silver beet and kale; the animal food difficulty could be got over by using green bone or meat meals specially made for poultry.

The best place for keeping fowls on the farm would be to devote an area of from one to five or even ten acres of well-sheltered waste land, in close proximity to the homestead. Let it be securely enclosed with wire netting, and the fowls can be kept there at the rate of 100 to the acre. But, as fowls always do better on an unlimited run, the system could be adopted of enclosing the buildings and sheds, such as stables, cart sheds, store-room, etc., where it is objectionable for fowls to enter; one system or the other should be adopted. The next question is as to what kind of poultry to go in for. Leghorns, particularly the white variety, are celebrated for their egg-producing qualities, and if a good laying strain of this breed can be obtained they will answer admirably, but, as they are non-setters, the incubator will have to be used, but if this is objected to, then take up a breed which do set, such as Wyandottes, Orpingtons, or Plymouth Rocks; these are good all-round varieties, that is, good both for the table and as layers; but, whatever fowls are decided on it is always better to have pure fowls and of one breed only. If there is, say, a sum of £5 available for purchasing fowls to make a start with, far better to buy a few good pure ones, not necessarily prize stock, but fair specimens of the breed, rather than in purchasing as many fowls of a poor quality as the £5 will admit. And if ducks are also to be kept, either pure Pekins or Indian Runners would pay best—the former for all-round purposes and the latter for egg-production only. But the point to be particularly remembered is not to delay, but set to work at once to avoid late hatching. Get the chickens out as early as possible June, July, August, and September are the best months for producing strong vigorous birds, after that the results are not so satisfactory, and if left until December and January the birds then reared are so often miserable, stunted specimens that do not pay to feed.

The Victorian Egg-Laying Competition.

In another part of this issue is reproduced from the *Australasian*, the report of Mr. H. Pye, the principal of the Dookie Agricultural College, on the recent egg-laying competition. The report is most interesting reading to poultry keepers, and goes very exhaustively into details; that part referring to the manner in which the fowls were fed is well worthy of careful perusal, and gives valuable data as to actual results from feeding a large number of fowls on a ration balanced for a good egg supply. But in checking the figures to trace out the final result of one part of albuminoids to 4·89 of carbohydrates, it will be necessary to multiply the total of the fats, viz., 40·70 by 2·3; thus making the total carbohydrates 1,044·710, which, divided by the albuminoids 213·60, gives the result of 1 : 4·89, which can be considered a fairly narrow ration. The foods dealt with in this ration are those generally used by poultry keepers in this State, viz., chaff-mat, pollard, bran, wheat; therefore any person who wishes can feed his fowls on similar lines, altering the quantities in proportion to the number of fowls kept, and if further experimenting is desired, a fairly full table, giving the analysis of poultry feeds, is obtainable in the New Book of Poultry, by Lewis Wright, from which balanced rations can be made from other ingredients than those at Dookie College.

Dookie Agricultural College.—First Laying Competition.

Owner, Address, and Breed.	Age (Months).	Eggs Laid (Six Hens in each Pen). Average Price. 1/5 May.	1/3½ June.	1/0½ July.	8 Aug.	7½ Sept.	8 Oct.	7 Nov.	9 Dec.	9½ Jan.	10½ Feb.	1/1 Mar.	1/3 April.	Totals.	Average weight per dozen (April).	Total weight of eggs laid.	Average number of eggs laid per bird.	Market Value.
															Oz.	Oz.		
1. G. Levens, Tunstall, White Leghorns	6	121	143	142	139	115	165	105	106	104	97	90	46	1,313	24¾	2,660·5	218·8	99/11½
2. G. F. Gates, Devenish, Minorcas	7¼	23	58	123	139	144	164	140	134	117	62	92	58	1,254	26	2,749	209	95/8¾
3. G. H. Commins, Wagga, N.S.W., Black Orpingtons	7	57	111	119	149	133	132	105	96	70	70	97	89	1,228	25	2,566	206·6	90/10¾
4. Miss Knox, Dookie, Minorcas	6½	21	79	98	96	134	158	140	160	117	92	72	51	1,218	25½	2,613·5	203	83/4
5. W. J. Hudson, Fitzroy, Pile Leghorns	6½	106	109	115	139	111	138	100	104	100	67	79	44	1,212	24	2,467	202	90/
6. R. Kerr, Seymour, White Leghorns	7½	87	61	69	124	147	158	138	137	97	86	68	38	1,210	26½	2,780·5	201·8	84/2½
7. Ponton and Son, Tuggerah, N.S.W., Langshans	7½	15	79	147	166	164	161	124	121	82	51	68	25	1,203	26	2,513·5	200·5	80/11¼
8. A. Fahey, Hallam's Road, Golden Wyandottes	6½	113	116	118	122	122	112	106	89	80	54	82	84	1,198	24½	2,421·5	199·6	91/5¾
9. W. F. Evenden, Croydon, N.S.W., Andalusians	8	45	69	100	127	152	153	120	105	78	61	75	74	1,159	26	2,495	193·2	81/2¾
10. W. T. Lawrance, Horsham, Brown Leghorns	6½	54	87	119	131	141	142	115	112	77	66	80	25	1,149	25	2,413·5	191·5	80/10½
11. J. A. Hooper, Dandenong, S. Wyandottes	7½	34	118	142	123	134	130	107	92	88	54	68	50	1,140	25½	2,468	190	82/2
12. A. Wedlich, Caulfield, Black Orpingtons	7½	25	100	123	128	145	142	114	119	81	64	62	22	1,125	26	2,425	185·8	77/5½
13. T. Lee, Glenlyon, Black Orpingtons	7¾	5	54	133	129	148	139	124	133	85	65	65	27	1,007	25	2,360·5	184·5	73/11
14. Ballarat Poultry Farm, Black Hamburgs	8	11	62	73	90	138	151	145	137	80	82	77	56	1,102	23½	2,168·5	183·6	74/6¼
15. Mrs. A. A. Werlich, Caulfield, Black Orpingtons	6½	61	81	139	142	132	132	106	78	62	60	72	20	1,085	25½	2,390·5	180·8	77/2
16. J. Boyle, Corindhap, Golden Wyandottes	6½	42	108	102	137	109	110	112	96	77	63	60	37	1,053	24½	2,181·5	175·5	75/2¼
17. Palmer and Sons, Hampton, W. Wyandottes	7½	39	94	93	107	91	103	87	77	97	54	74	78	1,048	25	2,171	174·6	79/8½

18. W. Wild, Lake Albert, N.S.W., Black Orpingtons	7½	39	43	63	122	100	136	120	116	103	82	73	50	1,047	26	2,279	173·5	71/10½
19. Mrs. Corney, Kyneton, Black Orpingtons	8½	85	100	89	115	119	123	90	98	70	48	75	25	1,037	25	2,248·5	172·8	75/11¼
20. J. Gibbs, Gowangardie South, Brown Leghorns	11	53	66	59	107	111	145	144	127	111	81	33	0	1,037	...	2,137·5	172·8	69/5½
21. Humphries and Hocking, Ballarat E., Buff Orpingtons	6	46	68	98	122	130	115	101	95	89	66	61	45	1,036	24½	2,083	172·6	72/10¾
22. J. M. Hepburn, Clayton, S. Wyandottes	7	45	62	129	141	141	95	86	85	56	61	75	53	1,029	25	2,075	171·5	72/6
23. W. G. Swift, Northcote, Buff Wyandottes	7½	0	53	136	115	156	125	110	90	72	43	43	68	1,011	25½	2,213	168·5	68/9½
24. D. Campbell, Elaine, S. Campines	8	28	36	66	88	124	138	135	124	102	52	65	26	984	24½	2,080	164	65/5¾
25. J. M'Donnell, Bundalong, Buff Orpingtons	8	111	83	70	83	93	113	83	94	72	72	59	48	981	25	1,983	163·5	74/
26. F. J. Wood, Ashfield, N.S.W., Minorcas	8	70	61	33	94	126	138	116	114	76	56	68	12	964	25	2,102·5	160·6	64/4¼
27. S. Sullivan, Wagga, N.S.W., Black Orpingtons	7½	0	30	108	125	134	139	114	109	57	41	61	43	964	26½	2,249	160·6	63/4
28. M. Ward, Thornleigh, N.S.W., S. Wyandottes	7½	29	86	92	104	114	109	90	92	67	56	66	41	946	25	1,964	151·6	67/3
29. Mrs. Stewart, Devenish, Black Orpingtons	10	1	52	82	109	112	106	97	96	81	79	91	23	929	28½	2,179·5	154·8	63/
30. W. T. Ely, Ashfield, N.S.W., Black Orpingtons	7¼	9	48	88	122	133	132	100	100	62	55	54	22	925	25	1,939·5	154·2	61/3
31. A. Starling, Darraweit Guim, Minorcas	7	36	37	85	107	114	116	89	85	83	61	61	29	903	25½	1,994	150·5	62/0¼
32. J. Kluge, Lyndoch, S.A., S.S. Hamburgs	11	2	17	42	102	195	152	129	130	72	45	43	18	897	24	1,765	149·5	55/7
33. H. Godden, Marungi, S. Wyandottes	7	33	52	84	101	109	111	80	85	56	62	53	31	857	25	1,867	142·8	59/7¾
34. W. S. Skelton, Dunolly, R.C. Black Orpingtons	6½	50	62	83	91	118	138	97	86	59	58	9	0	851	...	1,760	141·8	57/6½
35. L. C. Dowling, Woy Woy, N.S.W., Black Orpingtons	9½	10	54	38	124	146	129	117	92	29	25	14	0	778	...	1,700·3	129·3	44/0¾
36. W. Wilson, Wagga, N.S.W., Buff Orpingtons	7½	37	34	56	97	116	102	80	71	47	29	11	0	680	...	1,425·5	113·3	42/9¼
37. G. Blackburn, Yarrawonga, Brown Leghorns	6	9	23	35	63	102	104	82	94	51	53	19	1	636	...	1,292·5	106	39/11½
Totals	...	1,602	2,596	3,496	4,380	4,703	4,795	4,049	3,879	2,907	2,273	2,315	1,359	38,294	...	...	...	...
Average per pen ...	...	43·3	70·3	94·8	116·7	127·1	127·6	109·4	104·8	78·5	61·4	62·6	36·73	1034·9	...	...	...	...

Introduction to the Principles of Feeding the Birds.

In feeding the birds in the laying competition, most matters that bore on their productiveness were considered, as well as those embraced in their general management, such as cleanliness, shelter, exercise, and ventilation, which also are prominent features in promoting productiveness. It may be out of place in a report to dwell on the elementary principles of feeding, but the interest evinced by a number of enthusiasts encourages me to the belief that a short introduction would prove acceptable.

In plants, nature has many food factories. In them we find certain food products, which vary in sustenance power, according to the proportion of available starch, fat, or oil, and protein present. It is these compounds that determine more than others the feeding-value of a food, as they are necessary, as well as the most expensive of the food-products, especially the protein. The more digestible and palatable the better they are for the purpose of supplying nourishment and the more economically that may be used. The chemistry of digestion is not too well understood; also there is much to learn in respect to the part played by the micro-organism of the alimentary canal that help to reduce food-products to a fineness and solubility that make them easily availed of. I will simply content myself by stating that the farmer should be seized with the importance of knowing that he can maintain his poultry in better health and productiveness if he knows, in a general way, the parts played by the chief constituents of food-product.

The Principal Constituents of Food-Products.

The nitrogenous compounds are, perhaps, the most important substances of a food that the breeders of heavy layers would be interested in, since they are very necessary for egg-production, and are comparatively expensive. Protein is a term given to the nitrogenous matter contained in food-products, which go to form flesh, repair waste tissues, and is utilised in the formation of the white of eggs, as well as some of the yolk. For convenience it is subdivided into proteids and non-proteids. The former include albuminoids necessary for flesh, skin, feather, and egg-making, which will interest us most. The latter include soluble vegetable nitrogen compounds, often crystalline, called amides. Of these there will be little said, as they do not play so prominent a part as the albuminoids. As most tables of nutritive ratios give the amount of digestible albuminoids, etc., under the name protein, I have in general used the term, instead of the term proteid. Carbohydrates, and fats and oils, are compounds formed by the chemical union of carbon, hydrogen, and oxygen. These act as the fuel in order to keep up the body heat and the formation of fat. Though the above elements are arranged differently in fats and carbohydrates respectively, still, in a general way, they act somewhat similarly. Cellulose, which is also a carbohydrate, principally acts as a food-carrier, and is represented by the woody fibre in chaff, grasses, bran, etc. Water, a compound of hydrogen and oxygen, is a medium without which the work of building up the body could not proceed. The mineral matter is represented by the ash left after burning the food. This is principally represented by the bones, but some is to be found in the flesh and blood. The bones, as most are aware, are principally composed of phosphate of lime and the egg-shells of carbonate of lime, hence the importance of shell grit, which is also carbonate of lime.

Comparison of Foods.

It is by comparing the action of the nitrogenous or flesh-forming foods with the heat-givers, or those of a starchy or fatty nature, that the importance

of adopting a rational system of feeding is brought under notice. It was noticed that when much starchy food was given to the laying hens they did not lay nearly as well as when animal food was mixed with it, also that growing animals did not thrive unless the starchy and flesh-forming foods were present in the daily ration in proper proportions. This relation between the digestible protein or nitrogenous matter and the digestible carbohydrates and fat in a food is known as the nutritive ratio. It will be seen that to compare the protein with the carbohydrates and fat, it is necessary to reduce these two to some common term. It is found that the heat energy of 1lb. of fat is equivalent to that of almost 2·3lb. of starch; thus, if the amount of fat in a percentage composition be multiplied by 2·3 it enables us to add the product to the percentage of starch given, as both are now in similar terms. The list of foods to be mixed being given, and the parts of each supplied to compose the ration being noted, recourse must be had to the table of analyses of the foods, with the percentage of digestive nutrients stated. Then the amounts of carbohydrates are added, and to these are added the equivalents, in the carbohydrates, of the fats. This is, as already explained, obtained by multiplying the total digestive percentage of fats by 2·3, since one part of fat supplies as much heat energy as 2·3 parts of starch. Thus, to find the nutritive ratio of barley we look at the food tables and note that in the protein column it states 9·64, in the carbohydrate column 60·77, and in the fat column 1·86. Then the latter two are added, after reducing the fat to carbohydrate equivalents, and the total sum is divided by the amount of digestive proteine, which gives us 6·7. If there be two parts barley in a mixture, then the co-efficients are multiplied by two.

Laying Competittion Pens.

Table giving the approximate nutritive ratio of the morning and afternoon rations respectively, also the nutritive ratio of the rations as a whole:—

Parts by Weight.	Constituents of Rations.	Digestible Protein (Nitrogen us Matter).	Digestible Carbohydrates (Starch, etc.).	Digestible Fats and Oils, 1 fat = 2·3 Starch.	Nutritive Ratio.
Part					
1	Wheaten Chaff	3·60	46·1	1·10	1 : 3·48 of mash
1	Meat scraps, etc.	45·00	...	2·00	
5	Pollard... ...	5×12·2 61·00	5×53·4 267·	5×3·8 19·00	
2	Bran	2×11·2 22·40	2×42·2 84·4	2×2·5 5·00	
8	Wheat	8×10·2 81·60	8×69·2 553·6	8×1·7 13·60	1 : 7·16
	Totals ...	213·60	951·1	40·70	1 : 4·89 of morning and afternoon ration.

It will be seen that the proportion of fat and carbohydrates to protein is not as 1 to $\frac{1}{3}$ and 1 to $3\frac{3}{4}$, respectively, which is considered about the correct proportion. The nutritive ratio of the morning mash is, perhaps, narrower than some are used to give to laying hens; but undoubtedly the excellent returns from the competition pens encourage me to believe that in practice at least it has been a success. The wheat ration may seem to have too wide a nutritive ratio; but I do not think the bulk-wheat of the state has a much narrower one.

A nutritive ratio of 1 : 4·5 is considered by many English breeders about right, or the normal ratio. The term "narrow ration" is used to denote that the proportion of protein present in the food is higher than the normal, and the ration is said to be "wide" when the proportion of protein is less, or that the carbohydrates are in greater quantities than in the normal.

It is at the request of a few that I have added the table of the nutritive ratios of the feed-rations supplied to the birds of the Dookie laying competition. The difficulty of obtaining the correct nutritive co-efficients of the constituents of the rations make such tables less reliable than they might be, yet they serve a useful purpose in concentrating thought on the subject, and the feeding done is less empirical, and so less liable to mistakes. It is only within recent years that close attention has been given to the scientific feeding of poultry, and then only to a limited extent. The alimentation of poultry is so different to that of cattle, on which much research work has been based, that we can only hope for approximately correct results. We must supply a "maintenance ration" in order to keep the birds alive, *i.e.*, replace waste tissues, and keep up the body heat. We must also supply the neccessary surplus for the making of an egg for at least 200 days during a year. If it can be managed to rear a strain of birds that lay 250 eggs in a year the greatest prosperity is possible for the owner. As a rule, there are more eggs or ova in the ovaries than the bird lays. To stimulate the ovaries, and to encourage them to let loose an ovum from them each day, depends on the individuality of the hen, the food she eats, and her management. It may be possible that in the selecting of hens for laying purposes there will be a tendency to select those that have an individuality implanted in them which was marked in some laying strain that originally had been used in making the present breed, hence the type of prolific layers will take characteristic qualities, as do good milkers among cows. From the results of the laying competitions, it is evident that it is the strain, and not the breed, that qualifies a bird as a prolific layer, yet I believe the White Leghorn, whether from more attention being paid to it from practical breeders in the past, will, in a series of tests, maintain the premier honours. It remains to be seen, however, when the prolific strains of the heavy breeds are more commonly kept, whether the above statement will hold good.

Table of Average Daily Ration, with Cost per Week and Year of Constituents.

Proportion by Weight of Food.	Constituents of Food.	Weight of Food per Day.	Weight of Food per Week.	Price of Food.	Cost per Week.	Cost of Food, Year 1904-5.
Part.		lb.	lb.	ton. s. d.	s. d.	£ s. d.
1	Chaff, wheaten	3	21	45 0	0 5	1 1 8·7
				lb.		
1	Meat scraps	3	21	0 2	3 6	9 2 6
				bus.		
2	Bran	6	42	0 8½	1 5·85	3 17 6·7
5	Pollard	15	105	0 9½	4 1·87	10 16 8·4
5	Water	15	105	...	...	...
						24 18 5·8
8	Wheat	24	169	3 0	8 4·8	21 18 0
	Grit (shell)	...	...	...	...	1 5 0
	Green food	...	...	...	...	3 5 0
	Total yearly cost of food					51 6 5·81

REMARKS.—The chaff was steeped in water overnight until soft and pliable. An average of about 3oz. of the mash was given to each bird per day.

Annual cost of morning ration, 2s. 2·9d. per bird.

Annual cost per bird for wheat, 1s. 11·6d.

Each bird would, on average, eat, including grit and green feed, 4s. 8d. per year.

Egg-laying competitions are evidently firmly established in Australia. Whether they will accomplish all that their well-wishers expect of them remains to be seen. Without doubt they have already had the effect of rivetting attention to the utility side of the poultry industry in one direction only, viz., in the increased production of eggs at a lower cost than hitherto. There is another aspect of the poultry industry that must be more prominently brought before the producers—that is, the meat-producing side. To develop this is as essential, perhaps more so, than the question of egg production. As Mr. Hart pithily puts the matter, " the British public is not a customer for bones and skin, but for young, well-conditioned birds." The egg-laying competitions does not help to place this feature of the poultry industry on a proper footing, but it undoubtedly demonstrates that by judgment and observation every farmer or poultry breeder may raise the price of his wheat, seconds, and farm refuse to first-rate prices by judiciously feeding them to the right kind of poultry.

A Point to Consider.

I think it highly necessary to point out that in the effort to produce egg-laying strains of fowls with 200-egg records, that the degeneracy of the strain for table purposes is a most likely contingency, especially if the birds are fed in order to produce eggs. It is to be proved that the texture of the flesh and its palatableness remain unimpaired after long-continued effort in the direction of producing a heavy egg-laying strain. From the experience I have had there has been a deterioration, and I think it will be the experience of most breeders, hence the development of table qualities of poultry needs much attention also. The Department for Agriculture set a good example in giving a silver medal for the best quality table birds at the last Melbourne poultry show, when the exquisitely fine-textured flesh of the young Favourelles secured them the prize. Half the success may be due to the nature of the birds, the other half to the food and the methods adopted in feeding them. Hence I believe, if good substantial prizes were offered in order to develop this aspect of the poultry industry, the benefits to be derived will be useful and educational, especially if with each entry details as to the breeding and feeding were furnished.

The Agricultural College should, no doubt, lead the way in experimental work in this direction, but such work, if carried out properly, needs trained observers and suitable conditions, all of which cost money.

Much of the good work done is on the initiative of the sprinkling of enthusiasts in and out of the State's employ, who can rarely afford the expenditure, but as each year passes the rural population is making its influence felt in its demand for that scientific knowledge that may assist it to prosper and live more contentedly, and this is being recognised by the Government.

Location—Dimensions.

The competition pens are located on an eastern slope, and in general are well sheltered. Occasionally abnormally fierce hot winds blow, which prove trying, and account for a greater percentage of deaths than any other cause. The soil is not naturally suitable for poultry, being very heavy, sets hard, and during summer absorbs much heat, especially so as, owing to the very limited rainfall, the grass and lucerne dry up early in the season. Nature is assisted as much as possible in order to make the yards more suitable for the health and productiveness of the birds. Slab fences

are erected in order to break the force of the winds and for shelter, whilst numerous shrubs and trees were planted, but unfortunately the season was not encouraging to their growth. The Irish strawberry (*Arbutus nuedo*) pepper trees (*Schinus molle,*) white mulberry (*Morus alba*), mulberry (*Morus multicaulis*), silver poplar (Olive), and one or two pittosporums proved the more hardy, whilst the common bamboo proved ornamental and very hardy. The tree lucerne does not seem to succed sufficiently well unless the ground is well trenched and manured, owing to it being so hard and the soil so shallow.

Each pen is 25ft. by 62½ft. The enclosing fence is 7ft. high. The houses are of deal weatherboards, and are 4ft. by 4ft. by 3½ft. The front of each faces the east, and is slatted. Beneath the house is a scratching pen. The nests are placed at the north side, and are covered by means of a hinged door fixed horizontally to the house, thus facilitating the collecting of the eggs. The houses were sprayed regularly with insecticide. The floors were covered with sawdust, which facilitated their cleaning, which was done twice a week.

Food Supply, etc.

Fresh water was supplied every day, and on extra hot days twice. Shell grit was the principal form of grit supplied. Litter, in the form of straw, was also present, amongst which the grain food was thrown. The objects of the litter in the pens were primarily to give exercise and to keep the birds from eating their food too rapidly. Other objects for its presence were to act as a mulch, especially in summer, in keeping the ground cool and as moist as possible, and secondly, in encouraging a certain amount of insect life for the birds. The litter, when done with, acted splendidly in ameliorating the mechanical conditions of the soil where trees were planted, and it contained a certain amount of fertilising matter also.

What the Birds ate.

As the birds were kept for work and not for ornament, they were fed, as most workers are, on plain wholesome food, and sufficient to keep them in good health and with healthy livers. I am not going to say how much each bird ate, because I could not, but I can give you as nearly as possible about the average weight consumed by each, and that is about 6oz., or a little more if shell grit be included. Of course some ate less and some more. The Hamburgs and Campines ate very little, Leghorns a moderate amount; Minorcas and Langshans were rather greedy, as also were the Orpingtons, especially the black variety, and put on fat if not watched; whilst the Wyandottes, though eating less than the Orpingtons, were also liable to put on fat.

As there was no green food in the pens for over four months, there were very few supplementary mouthfuls, hence it was necessary that everything that was fed to the birds had to be of the best, and served, if I may say so, in as appetising a manner as possible, for that goes to make digestion easy, and life under the conditions more pleasant. It might be said that a bran and pollard mash could scarcely be spoiled, but it can very easily by making it day after day in a dirty trough with old sour mash not cleaned out, using dirty water, burning the meat and scraps, or feeding too dry or too sloppy. An occasional surprise sprung on the unsuspecting biddies in the shape of a dose of salts may be allowed. The birds here occasionally get this homely

medicine, with a little sulphur, in the spring and during moulting when the weather permitted.

Consider the work the six little white Leghorns have done during the 12 months. They have each eaten about 1cwt. of food, and from that and the water they drank and the grit swallowed have manufactured 219 eggs each, weighing about 28lb., added about 1lb. each to their weight, provided a new outfit of feathers, given ½cwt. of fertilising material, including some water and grit not in the food, and used up the rest of the food in living, that is, keeping the lungs, heart, gizzard, and other organs at work, and so creating warmth and pleasure. I think, farmers, these six pullets have not only given food for the body, but food for reflection also. It may turn your thoughts to your pastures and stock, and by analogy you may reason out many useful points that puzzle you. Presume you have these six pullets. Do you think you could get 219 eggs each from them? A few would say yes, but most would say no, simply because they do not know the most economical food to give them in order to obtain the desired result. The few who understood the business would say, if we fed the pullets on potatoes and other starchy food they would only get fat. There is not sufficient nitrogen present to make flesh and eggs in these foods, and would therefore take much of them before there would be sufficient nitrogen assimilated so as to make an egg almost every day, also the flesh, blood, and feathers of a full-grown fowl—in fact the pullet could not eat sufficient of such food only if it tried and produce 200 eggs a year; hence, if there are not quantities of insects about, the more observant breeder will give his laying flocks meat or foods rich in egg-forming matter. Meat is rich in the element nitrogen, so is the substance of an egg, and the nitrogen of meat is quickly assimilated, but the nitrogen in bran is not, therefore, it would take the digestive organs several days' work in order to get sufficient nitrogen from it to make an egg; the same may be said of wheat; thus it is that meat is so valuable an egg-producing food—its nitrogen is quickly available and turned into egg matter, principally "the white." On the other hand, if you give too much meat, egg formation is over-stimulated, and unless the constitutions of your birds are very strong they would be subject to ovarian troubles, and would most likely die. Thus it is that the rational method of feeding is to so regulate the fatty, starchy, and nitrogenous constituents of the daily ration so that you may get the maximum number of eggs from the minimum amount of food, remembering that the food must not be condensed as a tabloid, but of sufficient bulk to give the delicate absorbing vessels lining the intestines sufficient surface to work on. This dilutant or nourishment carrier is often the excess food and cellulose, or the woody matter, in grass, in chaff, and in the husks of oats and wheat (bran).

If you force your breeding birds to lay excessively, they would in time lose any constitution they may have had, hence you would not over-stimulate them, but when you are dealing with the egg-farming side you wish to get the greatest return in the quickest time, and have a new flock of birds coming in. When eggs are cheap it may pay not to stimulate during that part of the year—that is a business consideration, depending on your proximity to a refrigerating plant, your success in preserving eggs, or the profits in canning the eggs. As a rule, there is plenty of insect life about them, and you need not supply so much meat to the ration.

The wheat was principallly good seconds, and could be bought for 2s. 8d. or less at Dookie. The equivalent price in Melbourne would be 3s. The quantity of pollard used varied with its quality. In some cases it was

more like bran, and had less starchy matter in it. The meat was not given uncooked, and in some cases it was the remains of the stock pot.

The Preparation of the Mash.

The quantities of the different constituents of the mash being weighed out, the pollard and bran are put in the trough, which is 4ft. 6in. long by 3ft. wide and 12in. deep. This is then mixed up and the chaff or chaffed green stuff added. The above are then well mixed together and put at one end of the trough. Then the meat scraps and soup are placed on top of the mixture, and a little at a time is worked into a nice mealy mash, comparatively dry, but just moist enough to enable the birds to eat it without any trouble or waste.

Green Food.

The green food consisted principally of grass, barley, millet, rape, and kale, with a little sorghum. These are all good when fresh and crisp, but the rape and kale, when summer approached, were too strong flavoured and objectionable.

The Poultry Overseer.

The report would not be complete without a few words being written in regard to Poultry Overseer Clarke. It is greatly owing to his enthusiasm and attention to his duties that the first laying competition at the Dookie Agricultural College has been such a pronounced success. There is little doubt but that with the best of feed, unless it be given to the birds regularly and in a proper mechanical condition, the best results would not be obtained. I am pleased to say that Overseer Clarke attended to the feeding arrangements well, and also to keeping the birds as busy as their natures would allow, thus doing everything to encourage them to lay.

HOP GROWING.

By the Director of Agriculture.

From the experience so far obtained of hop growing in the South-Western District of this State, it is obvious that a profitable industry may be developed in hop culture. It is estimated that a gross return on the first season alone, based on the experience gained at the Hamel State Farm, would be from 40 to 60lbs. per acre, and under these circumstances it should be to the advantage of farmers to devote a portion of their land to hop growing.

The hop will grow nearly everywhere, but it is cultivated profitably only in a few places. A rich loam is the best soil, preferably a sandy loam. It should be moist, but not wet. The hop ground is prepared by deep

ploughing and thorough harrowing. The land should be tilled to a depth of 12 inches, and fertilised with bone-dust at the rate of six cwts. per acre.

Hops are propagated commercially from roots. These are from four to eight inches under ground; runners or layers which start from the crown of the main root near the surface of the ground and run out several feet

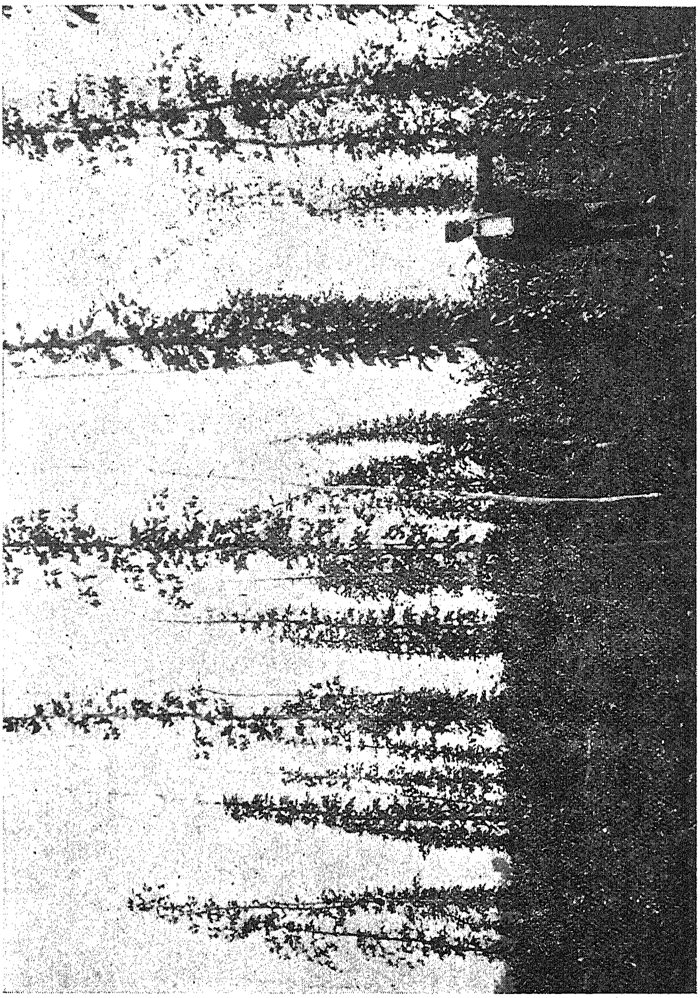


FIG. I—HOPS AT HAMEL (FIRST YEAR).

without diminishing much in size. Each of these root cuttings should contain two or more buds or eyes. While these cuttings will sustain considerable abuse or abuses, they must not be allowed to die out to such an extent as to destroy the natural life.

The root stock and runners of hops are shown in Fig. III. The plant should be set out the latter end of August or beginning of September. The rows are laid out seven feet apart each way; at the intersection two or three

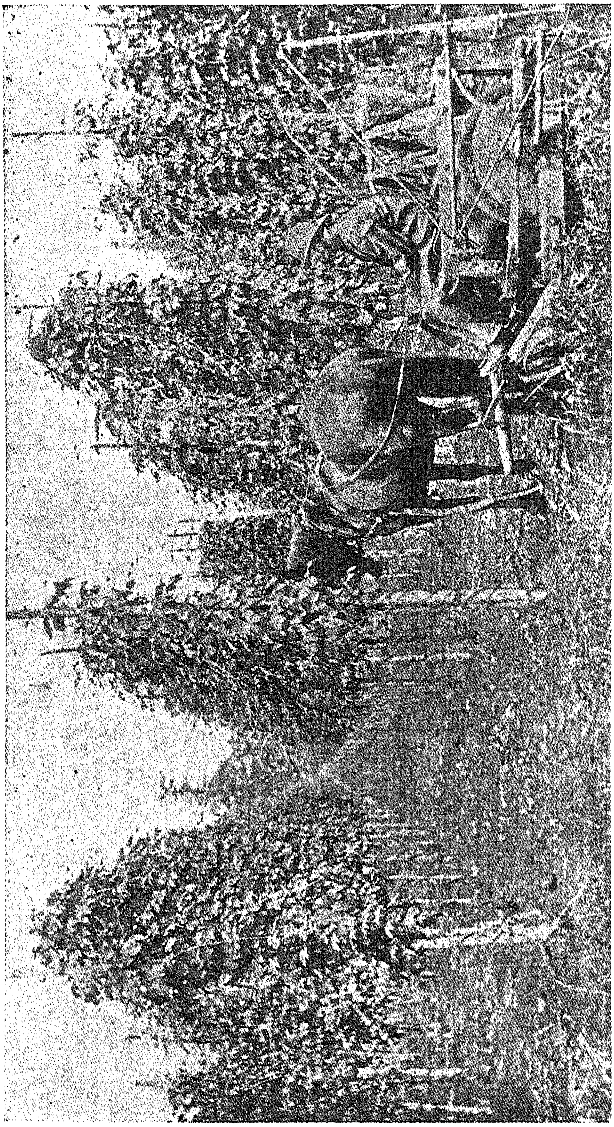


Fig. II.—Pole Training of Hops.

root cuttings are put in with a dibble or spade. These are placed about eight inches apart, and their tops placed level with the surface of the ground, and are then covered, two or three inches deep, with mellow soil. In every 10th hill of every 10th row a male or staminate plant should be set.

According to the *Farmers' Cyclopedia of Agriculture*, in some parts of Germany, where some of the finest quality of hops are grown, no male plants are allowed in the hop ground; but in Tasmania, United States of America, and England it has been found advisable to use in the proportion as noted above. They fertilise the female plants (*see* Fig. IV.), thereby producing seed and thus increasing the weight of the crop about 10 per cent. The hops set at the Hamel State Farm, on the South-Western railway, were planted on the 16th of September, 1904, and were ready for marketable picking on the 23rd of February, 1905.

Hop grounds continue to give paying crops for 10 or 12 years, after which the crowns become large and woody, the vines start late in the spring, and are hence less vigorous. At spring time, or thereabouts, the ground is ploughed up and reset. Care should be taken to see that the rows are made.

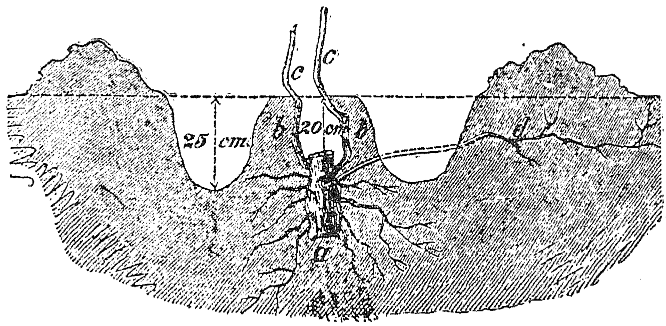


FIG. III.—THE HOP STOCK.

a Root stock. *b* Vine stock. *c* Dead part of last year's vine cut off.
d Roots separated or cut off by grubbing.

The following hints, taken from the *Cyclopedia* referred to, are interesting:—

PRUNING.—Beginning with the autumn or spring, after the ground is set out, and every year thereafter, the roots of the hop plant will require pruning. (*See* Fig. III.) This consists in removing the earth from around the hilt to a depth of three or four inches, the cutting off and pulling up of surface runners, and removing with a sharp knife about an inch of the old crown, together with the dead portions of the vine which were cut off at harvesting. The vines intended for hop bearing start on this new crown, and at this time diseased, weak, and dead roots must be removed; were removals are necessary, other sets should be put in. This operation being completed, the crown and roots are then covered again with fine soil, as before.

TRAINING.—When the hop vines have reached the length of about two feet they require to be trained on poles, as shown in Figs. I and II. One and sometimes two poles, 15 to 18 feet long, are set firmly in the ground at each hilt, and the vines trained to these. In many countries now poles are giving way to the high-wired trellis system of training. By this method rows of stout poles are set, at considerable distances apart, across the hop ground; wires are fastened to the tops of the poles, and strings let down from the wires to the hills.

HOP-PICKING.—This, as before stated, should take place in February. Hops are said to be ripe and ready for picking when the seed becomes hard, the point of the cone closes up, and the hop feels hard and solid when being grasped in the hand, making a rustling sound when touched. For picking purposes, vines are cut down and the hops picked by hand into boxes, baskets, or bins. They are usually picked by the cwt. of green hops or by the bushel. The wages for picking in Tasmania vary from about 2s. 6d. to 4s. 6d. per cwt. of green hops, and average about 3s. A good picker will gather from 150 to 200 lbs. of green hops per day.

CURING AND BLEACHING.—As soon as they are picked, hops are cured by artificial heat in kilns. This work is of a technical nature, requiring experience and judgment, and must be learned by practice. The essential features of a hop kiln are a light building, well slatted floor space for drying heat below, and ventilation above to carry off any moisture. The hops are spread on the floor in layers 18 to 24 inches deep, and subjected to heat from below for about 12 hours, the temperature being kept at 125 to 140 F. The hops are turned from time to time, so the drying may be even.

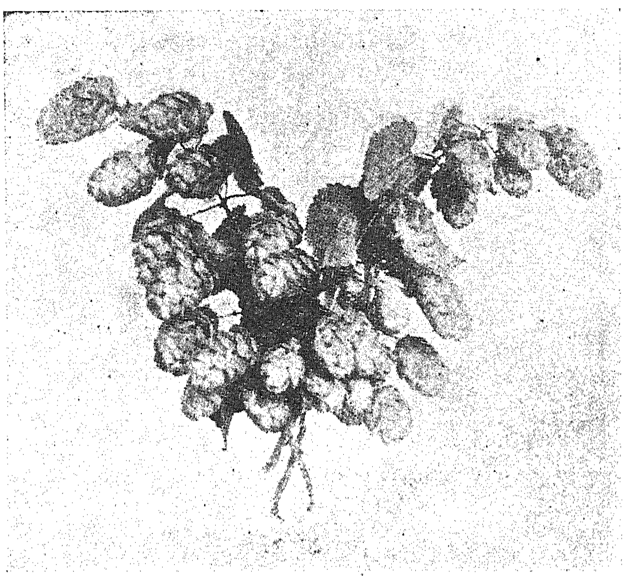


FIG. IV.—CLUSTER OF FEMALE HOPS.

In order to produce the yellow or straw-coloured hop which is demanded by some markets, the hops are bleached by subjecting them in their green state to fumes of burning sulphur. About 1lb. of sulphur is used to bleach every 100lbs. weight of green hops. It might be added that, in addition to bleaching, sulphur also has a preservative effect.

COOLING AND BALING.—After the hops have been cured and bleached they go to the cooling room, where they go through a sweating process, after which they are baled. Hops are usually compressed into bales 20 inches

square at the ends and five feet long. The weight usually for such packages is from 190 to 200 lbs. The process of compression having been completed, the hops are then sown up in what is commercially known as "Baling Cloths."

Average Cost.—The cost of producing hops may, on an average, be put down at about 6d. per lb. Taking recent ruling rates, the average price asked by Tasmanian hop growers is about 1s. 6d. per lb.

TREE PLANTING.

By A. Despeissis.

This matter is now seasonable, and before planting a tree or shrub, be it an ornamental or a fruit tree, a little attention given to the subject is always attended by good results.

In the pages of the Handbook of Horticulture and Viticulture of Western Australia, the question is dealt with at some length.

At this season it will only be referred to in a broad sense, and, to avoid repetition, the reader is referred to that publication for details on which more definite information is desirable.

Nature's method of planting trees is the simplest, but it is the least reliable. A tree bears a number of seeds; they fall on the ground; most of them perish. Some, finding congenial surroundings, take root after sprouting and grow; but a few only survive the accidents that fall to a plant's lot, and that is why a few young trees only surround the parent tree in the state of Nature. Though being the simplest, Nature's method is, therefore, little to be relied on.

When, on the other hand, we decide to grow trees in places which may not be quite congenial to them and force their growth to obtain the result arrived at, artificial methods must be used. By due observance of these methods, plants gathered from many climes and kinds of country can be grown in close proximity to one another, and be made to serve, with satisfactory results, the purpose for which they are planted. These artificial methods are of the simplest description, and tend to insure—

1. A suitable preparation of the ground which will carry the plant.
2. A proper setting of the young plant.
3. An efficient protection, while still young and delicate, against accidents or unfavourable conditions which may assail its roots, its stem, or its branches.

With the rainy season and the winter months, tree planting has now commenced, and may be carried on until the early spring, when the dormant plants will show fresh signs of growth, as both the air and the ground become warmer.

For the guidance of those who may not have that experience in tree planting which helps in insuring growth and in avoiding injurious practices, I will reproduce some notes recently contributed to the *Education Circular* of Western Australia and bearing on the conditions which, at the time of planting, may present themselves.

Preparation of the Ground.

If on clay, first pay attention to the draining of the soil. This is best done by cutting deep trenches in the direction of the slope, and either setting drain pipes on the floor of these trenches or else box drains made of some hard wood that does not rot easily, such as jarrah, and perforating these box drains with an auger; or, again, by packing stones or blackboy stems at the bottom and placing a litter of twigs or rushes on them and topping with soil.

After attending to the drainage, should drainage be required, break up the surface ground to a good depth. A plough with a strong team is best used for larger areas, or if a few trees only are to be set, holes may be dug about the depth of the spade. It is advisable to do this some days before planting, placing the top soil in a mound on one side and the deeper soil on the other side of the hole, which should be about three feet across. Exposure to the air and sun will sweeten the ground and better prepare it for the growth of the young roots.

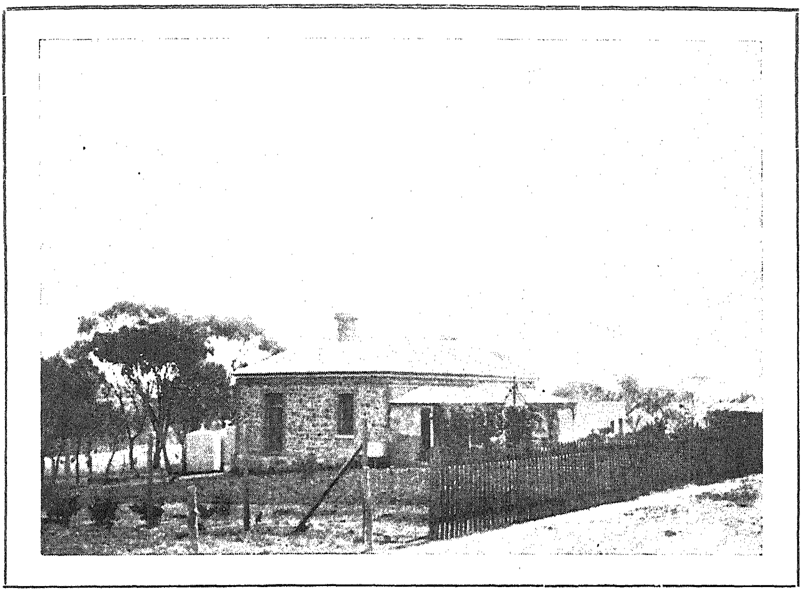
These holes should be so dug that when the trees are planted they either stand in lines or according to some symmetrical design.

The mechanical texture of the soil may often be corrected with good results when it runs to extremes. In a heavy clay a shovelful of lime or some sand will make it more friable. Light, dry sand, on the other hand, will be made more tenacious and retentive by an addition of earthy clay.

Where hard ironstone conglomerate underlies the top soil, or where an impervious hard pan stands as a permanent obstacle to the penetration of the roots, it is better to abstain from planting at all, or else the obstacle should be in some measure removed. A charge of blasting powder often effects this with good results, but both skill and caution are necessary when handling explosives.

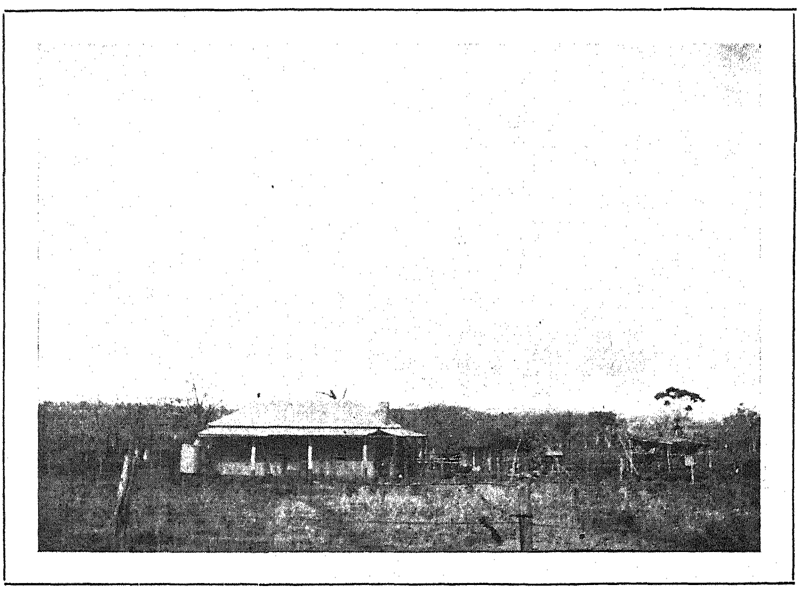
On the day of planting the hole is partly refilled, the top earth being placed at the bottom and rounded up in a mound in the centre. With it some well-rotted stable manure may be mixed, but never fresh or partly rotted manure. The latter, during the putrefaction process, gives off carbonic acid gas injurious to the young roots, or else often encourages growth of moulds which attack and destroy the roots or attract white ants, which at times eat through the young tree itself.

At this stage the admixture of some concentrated fertilisers to the earth in the hole will provide for the young trees food which will stimulate their growth. Some complete fertilisers compounded by mixing together two or three chemical salts and special fertilisers are better than either phosphatic, potassic, or nitrogenous fertilisers alone. Messrs. Couche, Calder, & Co., or



MOUNT HARDY.

MR. HUNTER'S HOMESTEAD. Capital to start with.



MOUNT HARDY.

T. COLLINS' HOMESTEAD. The average style of homestead in the

Gardner, Bros., of Perth, as well as some other produce and manure merchants, stock these and put them up in 14lb. bags, which they sell at prices ranging from 2s. to 2s. 6d. a bag.

A good sample of such complete fertilisers would contain ingredients reckoned as nitrogen, phosphoric acid, and potash to the extent of 3, 12, and 5 per cent. approximately. Half-a-pound of such a fertiliser, mixed with earth and well decomposed leaf mould or farmyard manure in the tree hole, will be a good dressing, and the cost need not exceed 1d. a tree.

For more extensive plantings, a mixture of either superphosphate, bone-dust, guano, blood manure, with well-rotted farmyard manure, is helpful.

Planting the young Tree.

On arrival of the package from the nursery, open it; the trees will either be found with their roots exposed or wrapped up with a ball of earth around them. If exposed, dip the roots, especially evergreen trees, in some liquid mud to prevent drying. If not ready to plant at once, heel them in without delay; that is to say, place the root butts in a trench dug in the ground, and cover them up with moist earth. When taken up for planting, the roots are examined, and trimmed with a sharp knive if found bruised.

The young tree is then placed upright, on the spot it is destined to occupy, on the top of the mound in the centre of the hole. Its base stands thus a little higher than the roots, which spread out evenly round, radiating outwards with a slight dip downwards. Bunched and entangled roots often lead to stunted growth. Trees at times die most mysteriously, which, when rooted up, are found choked up by one of their own roots girdled around the rest and preventing their natural expansion.

After arranging the roots and making them secure in their proper place with some earth, the hole is pretty well filled with soil, which is then trampled to consolidate. No air spaces should be left around the roots. A good plan of making sure that the earth is well set, is to pour a bucket of water around the tree; this will fill up all the crevices. Do not puddle the earth. On the top of this, some loose, fine soil is raked up to act as a mulch. It is better to plant a tree a bit high than too deep into the ground. On setting, the earth sinks a little, and carries the tree down with it. Deep planting is the cause of the failure of many a tree to grow.

If fruit trees are planted, they should now be cut back. This is made necessary by the tearing of the roots when lifting from the nursery bed; as the roots have been thinned, so must the top be reduced to re-establish the balance between the radical and the ærial systems of the plant.

Well-grown deciduous trees are also best cut back; but young potted plants, or plants with their roots all wrapped up in a ball of earth, may be left untouched.

After Treatment.

There is now little left to be done, and most trees, if left to themselves, will strike root as soon as both the air and the earth warms up under the influence of the spring sun.

Some trees are somewhat long and top-heavy, even at the time of planting, or else are set in exposed positions. It is thus advisable to tie them to a picket driven into the ground. This can be done in a variety of ways,

any one of which will answer, providing that no chafing and rubbing of the bark will result, as the plant is swayed by the breeze.

A good way is to drive a stake, either round or without sharp corners, slanting against the tree. Take a soft tie, pass one end between stake and tree and round the latter and again between tree and stake, thus forming a loop; then pull the two ends firmly around the stake and fasten in a knot. Such a tie forms a figure "8" around the tree and stake and minimises a good deal of friction and chafing. It also answers for straightening a curved stem.

When this is done, an effective tree guard and shelter to keep off live stock and screen off the strong wind in exposed spots, will be found necessary.

When the dry, summer months have set in, place a loose mulch around the tree; the material used may be stable manure, straw, or even sand. This mulch will prevent the rapid loss of the moisture in the ground by means of evaporation.

If it is deemed necessary to water the plant during the summer, it is well to bear in mind that one good watering, whereby water sinks down to a depth of twelve to fifteen inches into the ground, is better than toying half-a-dozen times with the watering can.

"COASTY" CATTLE.

The Director of Agriculture, during a visit to the Southern and South-Western districts, and when advocating dairy-farming in those localities, had his attention drawn to the necessity of farmers having to remove their cattle during certain periods of the year to country somewhat remote from the farmers of the settlers, this being necessitated by the fact of the cattle assuming a weakened condition and getting attacks of diarrhœa. Cattle affected in this manner are generally spoken of as being "coasty"; and the condition is common to herds pastured on the coast, more particularly on the lighter sandy soils. The chief inspector of stock says that this is practically a weakened condition of the circulatory system resultant on the food being of an insufficient nourishing character. The grasses growing on these lands are not of a lasting character, and, consequently, towards the end of summer the cattle have to exist to a great extent on the hardier scrubby plants, which frequently produce indigestion and weaken the condition of the system generally. The change at this period of the year to rich clay lands, where the pasture is of a more nutritive character is indispensable, but the removal of the cattle to this region may be obviated by means of artificial feeding, such as maize or sorghum, and supplying together with each a daily ration of bran and a little salt to keep the animals in good health all the year round. When the farmers have succeeded in establishing good, permanent nutritious pastures of exotic grasses it will no doubt be found that the "coasty" condition, as it is termed, of cattle will no longer exist.

INSECT PESTS ACT.

Mr. T. Hooper, Chief Inspector under the Insect Pests Act, has issued a report to the Director of Agriculture as follows:—

"On Tuesday, June 6th, I left Perth for Bridgetown to inspect the orchard of Mr. Godfrey Hester. This orchard is some 40 acres in extent, and two years ago about 13 acres were badly infested with the San José scale.

"In order to eradicate this pest Mr. Hester sprayed first with 'lime, sulphur, and salt' wash, and at an interval of 10 to 14 days followed it up by spraying with an emulsion of vacuum oil composed of one gallon of oil to ten of water and 2lbs. of soft soap. The lime, sulphur, and salt acted as a background for the oil wash, which, when applied, showed dark, the contrast enabling the operator to make sure that all parts of the tree were covered by the spray.

"As a result of this treatment Inspector Wickens found only 15 trees infected last winter.

"This season Inspector Wickens and myself carefully examined every tree and found all the trees clean except eight out of the 15 found infected last year, and in each case found it was very slight.

"Mr. Hester informed me he had last season sprayed the whole of the orchard again, but had reduced the strength to 1 in 20 of the oil, being the second spraying.

"The reason, he considered, the fifteen trees were not all cleaned, was that they were sprayed during wet weather. All the trees now infected are at one end of the orchard only, and not scattered about. The fact that no trees were found infected, except amongst those found last year, is evidence of the very careful work done by Inspector Wickens.

"Mr. Hester informed me that when the sun was warm it acted on the oil and caused it to creep. This creeping or spreading tendency is, I think, of great value, as it causes the wash to penetrate crevices, and covers, when well applied, every part of the tree.

"It is necessary it should be applied in dry weather and before the buds swell, as Mr. Hester lost the crops and a few trees, and, in some few cases, killed the trees through the sun drawing the oil on to the tender buds and blossoms.

"As the results of this treatment are eminently satisfactory, I submit this report for your information, and would respectfully suggest for your approval that this treatment be used as an alternative to fumigation for the destruction of the San José scale.

KIMBERLEY DISEASE IN HORSES.

The following is the text of the findings of the recent conference in connection with the Kimberley Horse Disease and is signed by Messrs. R. E. Weir, M.R.C.V.S.; E. A. Le Souef, V.S.; and H. H. Edward, V.S.

Definition.—A disease of variable duration, occurring in pastured horses, and characterised by symptoms of congestion and derangement of the brain.

History and General Remarks.—Kimberley disease in horses has been known to exist since the earliest days of settlement in the North; but, although several theories have been advanced as to the cause of the malady, nothing definite has been decided as to its origin and exact nature.

The area over which the disease may be met with is described as from Broome, northward and westward through the two Kimberleys to the coast. It has caused and is still causing great annual mortality amongst the horses. The yearly loss is on some stations as high as 75 per cent. It is interesting to note that it is worse in some years than in others, and may even miss a station for one or two years, but the station owner is slow to congratulate himself as he knows only too well that next year will probably send his spirits down to zero.

Herbage, Water Supply, Natural Conditions.—The herbage on the rising country is coarse to an injurious degree so far as the horse is concerned, but on the flats a lighter and more digestible feed prevails. The country is watered partly by rivers which, however, are salt for a great distance from their mouths during the dry time of the year, but for the greater part by pools and lagoons.

The only horses kept on the majority of the stations are those used in the working of the place. They are, therefore, animals under control, and although such preventive measures have been adopted as the owners' theory of the cause of the disease would suggest, rarely have they been attended by success.

To alter natural conditions in a place like Kimberley is not an easy matter it is true; but it is gathered from the evidence taken that the preventive measures adopted have not been extensive nor have they been systematically carried out.

When the rainy season sets in the vegetation springs up with great rapidity, and it is at this time that the disease is so rife. The dry season of Kimberley begins in April and lasts until the end of November, or early in December. During this time the rank tropical growth undergoes one continual drying process, and all that was succulent at length becomes hard and fibrous. The question at once presents itself, how do the cattle escape? for we are dealing with one of the greatest cattle countries in Australia.

Immediately the grass begins to go off, the cattle make for the top feed—the tender shoots of the shrubby plants with which the country abounds, and upon which they thrive excellently. Horses, however, do not touch the top feed, but continne throughout the dry season to feed on the herbage, no matter how hard and dry it becomes.

During the dry season the rainfall is practically nil; but in some seasons there may be sufficient from time to time to produce an indifferent growth of green feed. This, in the light of what is to follow herein, may account for stations being unaffected by the disease for two or three years at a time.

THE SYMPTOMS.—The symptoms are really those of what is commonly known as stomach staggers—really a congestion of the brain, caused by reflex gastric irritation. The animal is noticed to be dull, standing awkwardly, with his head held low. His coat is staring. The eyes are glassy, and no notice is taken of the surrounding objects. The horse does not lie down, but persistently endeavours to keep his feet throughout. He walks about in a wandering, aimless way, generally in a circle tending one way. If he encounters any obstacle, he will either stumble over it or lean his whole weight against it. Thus he may be found with his forehead firmly planted against the trunk of a tree, or with his breast against a fence. Invariably in these wanderings he falls; struggles to his feet again, and continues his delirious march. Finally, being unable to regain his feet, he struggles at intervals until death takes place.

THE CAUSE.—In seeking the cause several local conditions and circumstances were submitted by the witnesses examined. The fact that stomach worms are very prevalent in horses at Kimberley engendered the idea that the disease was parasitical in its nature, but evidence given by the Messrs. Rose, in which they stated that horses landed from Perth became affected within a few days of landing, told against the theory. The Darling Pea was also suggested, but as the disease was said to occur irrespective of the presence of this plant, this theory was dismissed. In our opinion the cause of the disease is not referable to any one factor entirely. That is to say—that the extraordinary mortality cannot be ascribed solely to the action of worms on the walls of the stomach, nor to the indigestible nature of the herbage or the violent change from the coarse dry feed to the young grass when the rainy season commences; but that the three factors combine to produce the disastrous effect.

The presence and effect of the parasite is looked upon as the predisposing cause, and the coarse food, especially when acted upon by the stomach by the sudden ingestion of green food, as the exciting cause.

The evidence upon which this conclusion is founded is ample:—

(1.) Animals do not suffer on the plain country where the light grasses abound, such as Mitchell grass and Flinders.

(2.) The worms found in the stomach are general, and it would be unusual to find on P.M. examination a stomach without them. They are, moreover, found in the stomach of horses in all parts of the world. They are identical with the *Spiroptera Megastoma*.

(3.) There has been no evidence concerning the mode of death that would suggest peforation of the stomach by worms.

(4.) One station owner whose holding is all flat country is able to breed horses with impunity, while his next neighbour on rising and hilly country, bearing coarse feed, lost in one year every horse he had.

(5.) The identical symptoms can be produced by loading the stomach with similar ingesta to the hill feed of Kimberley.

Preventive Measures.—The establishment of a home cultivation paddock is of the utmost necessity, for the production of lucerne and other edible and easily digested green food-stuff will ameliorate the disastrous losses of stock owners. For it must be seen that not only do they lose their horses, but that all the work of the station is interfered with. It is true that when the horses are working out back, the fact of there being plenty of proper food at home will be poor consolation for the stockman whose horse goes mad under him; still, the good feeding which the animals will receive at the homestead between times will doubtless prevent many an attack.

In like manner bran mashes and any other sloppy feed, given at opportune times, will stand the horse in good stead.

Enough has been said about the cause of the disease for the stockman to be guided in what manner, under the circumstances surrounding him, he may judiciously feed his horse. One thing will most certainly suggest itself, and that is, that in his movements he will camp on the flat country as much as possible.

It is interesting to note that mules do not succumb to this disease as do horses, and that they are hardier in every respect. It is urged, however, that they are not active enough for work amongst cattle; but it must not be forgotten that they can be bred up to a very high standard.

In Mr. Le Souef's opinion, the zebra mule will prove to be a highly useful animal in the North. Certainly for general purposes work we strongly recommend that mules should be bred, more especially on those stations which are known not to be suitable to horses.

The Board of Inquiry has had brought under its notice the fact that when Mr. R. E. Weir, M.R.C.V.S., now Chief Inspector of Stock, was on a visit to Kimberley some seven years ago, he formed an opinion as to the cause of this disease, which is thoroughly indorsed herein. He also advised the adoption of certain preventive measures. These consisted, in part, of the cultivation by the aid of irrigation of such vegetation as would provide a digestible and succulent diet through the dry season. In only one instance has this advice been followed. Mr. Collins, of "Oscar Range" Station, who took the trouble to irrigate, cultivate, and to otherwise carry out the suggestions of Mr. Weir, has reduced his losses from 50 to 3 per cent. He could not attend to give evidence on this occasion, but wired to the Board. In his message he states that he is convinced that the Kimberley horse disease can be greatly controlled by the use of the plough and irrigation at the homestead.

It seems odd that, although at the time this same advice was embodied in a published report, on only one station was it followed in anything like a practical way.

Treatment.—As in the scientific treatment of disease one is guided by ever varying conditions, we are loath to say that the line of treatment advised will be found to be positively effectual in restoring all affected animals to health; but while we most strongly urge the adoption of the preventive measures recommended we also advise that animals affected should be treated thus:—

To administer medicine in the usual manner, viz., by drenching, may be attended with some danger. In the first place the symptoms would be aggravated by endeavouring to secure the horse in the proper position for drenching, and even if he were properly secured there would be every

possibility of some of the fluid getting down into the lungs through his inability to swallow properly. For, in common with the rest of the muscular system, the muscles used in swallowing are affected. In these cases the simplest, quickest, and most certain way of introducing medicine into the system is by hypodermic injection.

Injection of one dram of Phenazone (Antipyrin) three times a day, if necessary, will be found to have a very controlling effect, and to bring the horse so much to his senses that he will be inclined to eat. If near the homestead a sloppy diet should be provided and the following powder given in each feed on the first day ;—

Calomel, $\frac{1}{2}$ dram.
Ground ginger, $\frac{1}{2}$ ounce.

On the following day, and for so long after as may be thought necessary, give in each feed—

Common salt, 1 teaspoonful.
Epsom Salts, 1 ounce.
Ground ginger, $\frac{1}{2}$ ounce.

The application of cold wet swabs to the head is recommended, but not if they seem to annoy the animal. The horse should be kept quiet, and should have drinking water always before him acidulated with strong sulphuric acid to the extent of 10 drops to the bucketful.

A cheap and strong hypodermic syringe is obtainable in Perth, and as this and the remedy suggested can be easily carried in his pocket, the stockman could always be equipped with remedial means. The place to inject is where the skin is thin about the girth, and the operation is performed as follows:—

To write of antiseptic precautions to the man in the bush is absurd. Suffice it to say that cleanliness is of the utmost importance. Have everything clean, and wipe or wash the skin in the region of the operation. Dissolve the Antipyrin in about two tablespoonfuls of hot water which has previously been boiled. Fill the syringe, and then proceed to insert the needle. Taking a fold of skin between the thumb and forefinger of the left hand, drive the needle down with the right as far as it will go, directing it so that it passes in close contact with the skin the whole way. Then fit the nozzle of the barrel into the butt of the needle and force the fluid in. For each subsequent injection select a fresh place; but keep about the lower part of the girth as much as possible.

The Board recommend this method only as a rational means of controlling the symptoms exhibited, and does not promise that the disease will be thus effectually cured, or that it will not recur.

ILLUSTRATIONS.—The illustrations appearing in this issue of the *Journal*, referring to the repurchased estates at Mount Hardy, Cold Harbour, and Gwambygine, should have appeared in the June issue in conjunction with the report thereon by Mr. C. E. May, Chief Inspector of Lands, but, owing to the very large number of illustrations appearing in the last issue, were held over for the present issue. In both issues illustrations were printed by the Paragon Printing and Publishing Company in double-tone inks.

DUMBERNING AGRICULTURAL AREA.

The following report has been forwarded by Inspector G. M. May, of the Lands Department, to the Under Secretary for Lands:—

"This area, which comprises about 28,000 acres, adjoins the Narrogin townsite on either side of the G.S. Railway line, the greater part being on the West side, through which the main road to the Williams runs and the first section of the Narrogin-Collie Railway is now being constructed.

"The soil, for the most part, ranges from good red chocolate loam to lighter sandy loam, all eminently suited for the growth of cereals, and is good grazing country after being ringbarked, good water being obtained in all parts at a comparatively shallow depth. All but about 3,500 acres has been already selected as first-class land, the balance being mostly rough and poor and unsuitable for agriculture.

"The principal holdings are those of Messrs. W. Weise and J. Davine, on the East side of the G.S. Railway; and the late R. T. Glasson and Messrs. Wm. Graham, P. D. Nash, J. Stevens, W. L. Graham, S. S. Cowcher, C. R. Richardson and others, on the West side. On most of these, which have been occupied for several years now, substantially-built homesteads have been erected, also stables, sheds, etc.; and, in addition, a large amount of clearing, cropping, and fencing has been done; whilst on Messrs. Weise, Graham, and Richardson's considerable attention has been paid to the planting and care of orchards. There are also a number of later settlers who are just getting fairly started and should, in the course of two or three years, be obtaining a good return from their holdings.

"The Government Experimental Farm is situated on either side of the Williams Road, about four miles West of Narrogin, and the good work which has been done on this place is too well known to need more than passing reference now. Needless to say, the results of the numerous trials of the different wheats and manures which are made annually are watched with great interest by many farmers in this and other localities.

"I estimate the approximate amount of improvements which has been effected in this area up to the present time as under:—

	£
Clearing 4,000 acres	8,000
Cultivating 4,000 acres	2,000
Buildings...	2,000
Stables, sheds, etc.	1,000
Water	600
Fencing	2,000
Orchards	400
	£16,000"

THE SEEDLESS APPLE.

By A. Despeissis.

Much has been written of late, both in the American and the Australian horticultural papers, concerning the seedless apple.

The revolution which was predicted early in the day regarding the planting of future orchards is, however, still to come, and the seedless apple has yet to take amongst pome fruits the position that the seedless orange or the seedless currants and sultana occupy amongst citrus fruit and grapes.

The more it is examined, studied, and compared with other commercial varieties, the less promising seems its chances of being long-lived in the public favour.

Advertised with great push and enterprise, the "Spencer Seedless Apple," says the *Rural New Yorker*, was floated into a company with a general manager, assistant manager, and a whole organisation for the propagation of seedless apple trees.

Three of the photographs here reproduced are borrowed from the *Rural New Yorker*. One represents a picture of an entire apple (exact size); another, a transverse section; and a third, a longitudinal cut, which, by-the-by, brings to view a *seed*.

The so-called seedless apple is, therefore, not seedless; and it is now announced that "perhaps 10 per cent. of the apples show seeds or indications of them."

Although it is readily admitted a great many are seedless, they, however, all have a horny core or woody carpels, which are the envelopes which surround the pips, and in that respect they are not superior to any other commercial apples.

On many other points, on the other hand, they are inferior to them. They are said to be "rather small in size, round and smooth in form, dull red in colour, with many light dots. The calyx is very large and open, and the basin is wide and deep, extending almost to the core. The flesh is white and firm; quality very ordinary," almost ranking with Ben Davis in flavour.

The contention that it is "the best evaporating apple because the core is small"; it contains 25 per cent. more "meat," or flesh, than any seeded apples; it is a good keeper, and is a "novelty," are also now all exploded. "The claim that the seedless apple contains 25 per cent. more apple substance than other varieties of the same size, is scarcely borne out in the specimens examined, or the substance lost by the large, open calyx basin would quite offset any gain in the spaces normally occupied by seeds."

As to its being a "novelty," there is room for doubt.

In juxtaposition with the illustrations of "the Spencer seedless apple" from the *Rural New Yorker*, I am able to give some good illustrations from photographs taken by Mr. Pether, the head of the Government Lithographic Department at Perth, of some apples grown near Bridgetown, in the Blackwood, by Mr. Alfred Doust.

These apples are not chance trees from a seedling. Other trees of the same kind were planted and fruited at "Avondale" (Messrs. Bull and Stevens' orchard), and also at the Coorinja orchard (both in the Toodyay valley), and at Mt. Baker orchard, on the Darling Range.

The trees were supplied by Mr. J. Hawter, late of Smith's Mill, and now of the Blackwood Nurseries, one of the most enterprising nurserymen in Australia.

"I imported these seedless apples, *Menocher's No Core*," says Mr. Hawter, "in 1892, from France, where I saw it fruiting 20 years previously, and a full description will be found in my three first issues of catalogues, 1893-96; but since fruiting I have left it out of subsequent issues, as it would never be a commercial fruit, but an interesting botanical curiosity. I distributed a good many trees in those years all over Western Australia."

At my request, Mr. G. H. Wickens, of this department, orchard inspector at the Blackwood, sent me a small box of these "seedless apples," and whilst making sections of several of them for photographing and for examination of the internal organs of the fruit, an apple was cut which contained *a seed*. Mr. Wickens' experience in that direction is also similar to ours.

Speaking of Mr. Doust's trees, he says: "Mr. Alfred Doust bought the six trees growing in his orchard from Mr. Hawter about nine years ago; they are not big trees for their age, but this is probably owing to the situation in which they are placed, as they equal in size other varieties growing in proximity. The trees have no specially marked habit of growth, being neither very upright nor yet exceptionally spreading, but something midway between. The bearing qualities have not been very satisfactory so far; last season and this a medium crop was gathered, but up till that time the trees had only produced a few specimens.

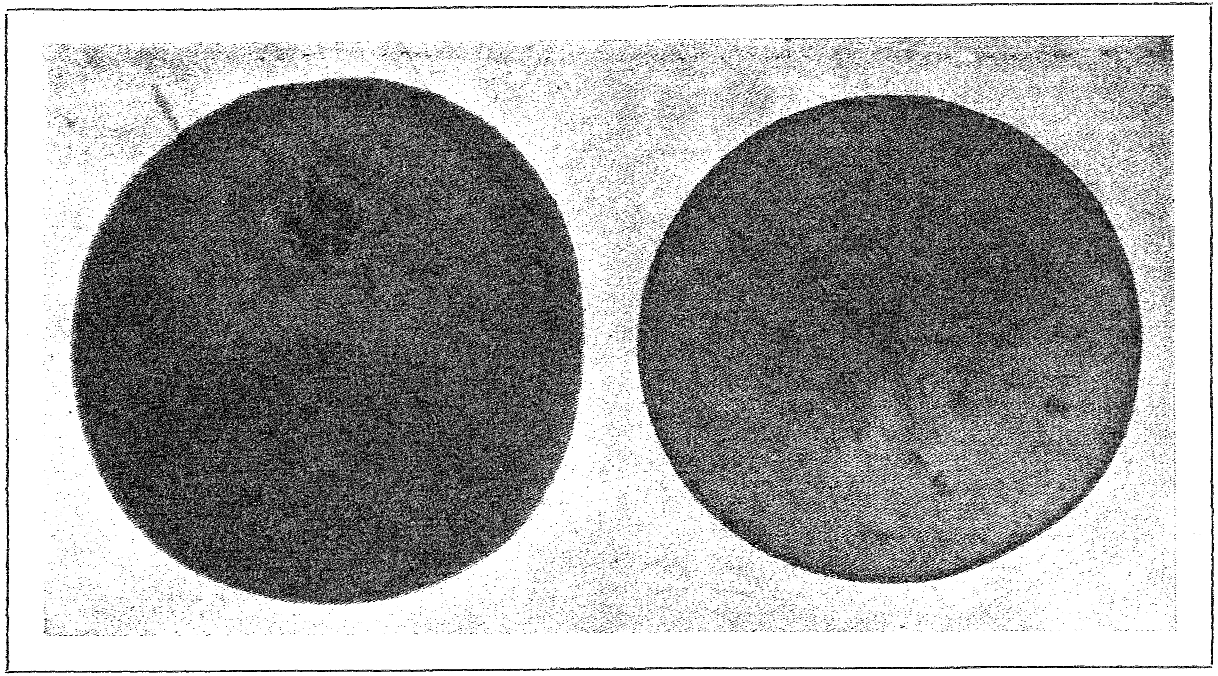
"Numbers of the young fruit drop off at the period of setting, and an apparent heavy crop is turned into a light or only medium one.

"Mr. Doust says that a marked peculiarity is the entire absence of petals at flowering time, the trees appearing as if absolutely devoid of blossom. If I should be here next spring I will forward you a branch.

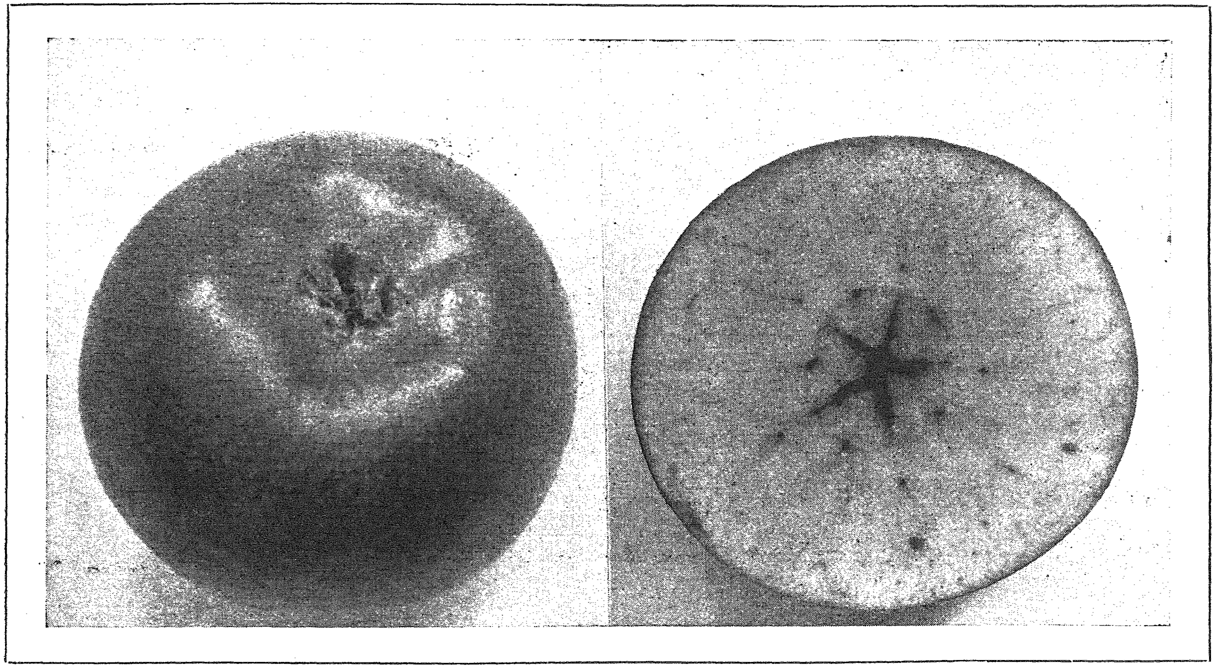
"The tree is not blight proof, though apparently not very subject to attack. You will notice in the specimens I am forwarding one carries some woolly aphides in the deep cavity of the eye, which offers a shelter for them and harbours the insect.

"The fruit will keep right through the winter months, being one of the best varieties grown in the orchard for storing. Its quality for desert purposes is fair, but unfortunately it is not by any means an apple to take the eye."

These apples reached me towards the end of May, and now at the beginning of July they are apparently sound externally, but several of them show inside evidence of ripe rot or *Gloeosporium* fungus.



The Spencer Seedless Apple—Natural size. *(Rural New Yorker).*



MENOCHER'S NO CORE APPLE—Natural size. The same transversely cut. (Local).

I here give a brief description of the fruit:—

Form: Oblate, irregular outline.
Size: Medium, $2\frac{1}{2}$ inches by 2 inches high.
Stalk cavity: Shallow, rounded, lined with russet.
Stem: Short, half an inch long.
Basin or "blossom end": Corrugated.
Calyx: Large, funnel-shaped.
Colour: Orange background with red pencillings.
Flesh: Firm, juicy.
Core: Long carpels or seed capsules; no seed.
Flavour: Subacid.
Quality: Fair to good.
Season: Late autumn.

Without going so far, without a direct examination and close comparison between the two alleged seedless apples, as to say that the Spencer seedless apple is identical with the old-known Menocher's No Core, it is evident that the two have, one with the other, features that are closely alike.

Some Notes on the Wheat "Bobs"; its Peculiarities, Economic Value, and Origin.

By W. Farrer.

(Continued).

Origin.

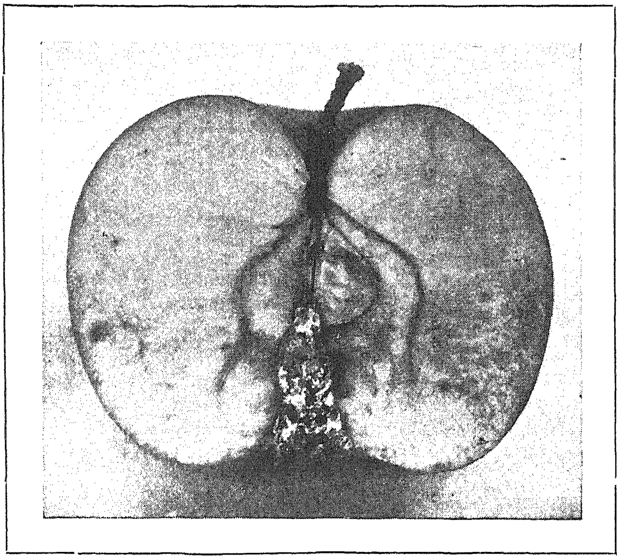
I will now go on to give the history of "Bobs," which is very interesting; and, because it contains points which may be of value to other plant breeders, I shall give it at considerable length. On 21st October, 1896, I made an unusually interesting cross. The mother was a wheat which had been derived from a sport of Blount's Lambrigg, and had been given the provisional name of M (F); and the father a strain of Nepaul Barley which I have been making use of for about 15 years for the purpose of separating varieties of wheat when more than one are planted in the same drill. This barley, which goes in my field books under the name of BSB (Bald Skinless Barley) is specially suitable for this purpose, because its leaves are of a peculiar light green colour, and from the very first are broader and stiffer than the leaves of any wheat I know. The cross was a troublesome or rather a tedious one to make on account of the difficulty of getting ripe pollen of this barley; for its flowers are closed, and on that account its ears cannot show that they are in flower by the protrusion of anthers which have shed their pollen; but I was encouraged to attempt it by the

circumstance that Mr. Maddox, of Tasmania, had already succeeded in crossing this barley and a wheat. Ripe pollen, however, was obtained, and the cross made, as I thought at the time, satisfactorily. As it is always necessary in making crosses, in which the mother's own pollen is likely to be prepotent over the pollen which is being used for the cross, great care was taken to guide against self-impregnation. Although several flowers, probably about a dozen, were operated upon, only a single seed, and that so small and pinched that I had considerable doubt about its germinating, was secured from this cross. When the time of planting came, every chance was given to this seed. It germinated and everything went well with the plant it produced. In the next drill, and immediately opposite to the crossed seed, uncrossed seeds from the mother were planted at the same time. This is what is always done when seeds are planted which have been made by crossing; for it allows differences from plants of the mother-variety of the same age, which plants growing from the crossed seeds may show, to be conveniently noted. Such notes are important; for it is a matter of experience that differences which are enough to show that they are such are sometimes seen in crossbred plants while they are young, and afterwards disappear. In this case, I noted from the first differences between the crossbred and its mother, which became more prominent as the plants reached maturity. The crossbred, or rather hybrid, plant had foliage of a lighter and fresher green than its mother, and in this respect somewhat resembled its father. Its straw also was much weaker; so weak indeed, that there appeared to be very little likelihood of anything of practical value ever being obtained from it. The differences, however, between the hybrid and its mother were mainly confined to these points; for in the ears very little, if any, could be detected; while the grain of the hybrid seemed to differ, if anything, more from that of the father than did the mother's. As the next would be the variable generation—that in which the greatest and most numerous variations are usually seen—I felt much curiosity as to what the seeds of this plant would produce. Neither in the early stages, however, of their growth nor later on, could anything striking be detected in any of the plants to remind me of their BSB parentage; nor were there any conspicuous differences between the plants themselves. The slight differences, however, which can usually be seen in the variable generation of crossbreds, the parents of which are not very widely separated in type, were noticeable and these were sufficiently distinct to show that a variable generation was being dealt with. As the plants approached ripeness, some of these differences became more pronounced; but while the straw was distinctly weaker in some plants than in others, in none was it so weak as had been that of the mother plant; and all the differences continued to be of a minor character, and of the nature of not very considerable divergences from the parent M (F). The entire absence of resemblances to BSB puzzled me greatly, and caused me to doubt the accuracy of my observations of the previous generation. As is usual in dealing with a variable generation, the best plants were marked, and they alone harvested separately. In consequnece of the unexpected entire resemblance to wheat of all the plants of the variable generation, seeds from the plant which was selected as the best of them were planted in a drill, on either side of which were drills planted on the same day with the mother variety M (F). This was done to make sure that my supposed crossbred was not after all nothing more than the mother variety. These drills were watched with special care from the time the plants first appeared above ground and throughout their growth. The frequent comparisons which were made showed beyond doubt

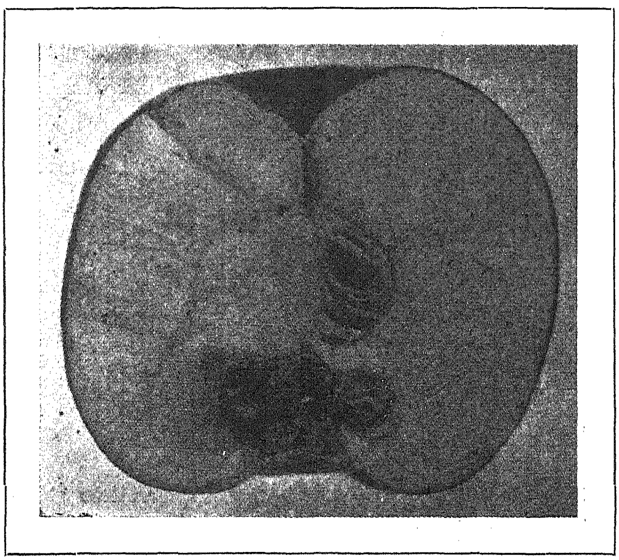
that my supposed hybrid was, at any rate, not identical with its mother; for amongst other differences its foliage was of a distinctly darker green. On the face of it, this was remarkable; for although M (F) had itself foliage of a rather light green colour, the hybrid plant of the first generation, as I have already said, was of a still lighter colour—so light, indeed, as to cause me to think that it had in this respect taken after its barley parent; but as in selecting the best plants from the variable generation, I am in the habit of preferring such as have foliage of the darkest and richest green, this circumstance shows no more than that the plants of the variable generation had varied in the colour of their foliage. What, however, was most remarkable was that in the case of so violent a cross as this, the plants of a generation so early as the third should be in every respect so even as were the plants in this drill. No difference, in fact, was observed either in the form of their heads or in the manner or vigour of their growth; the plants appeared to be as level-headed and the drill as pretty as ever I had seen of a wheat; and so well fixed did the crossbred always look to be that I did not hesitate to accept it as a variety, and to give it a name. In the following year, while the plants themselves did not show any unevenness and continued to be of the same character in every other respect, the heads were not carried at so uniform a hight; and on that account the crop was less attractive. This circumstance disappointed me until reflection had suggested that the character of the season was likely to have been the cause of this inequality. Subsequent observation has caused me to see that hot winds or spells of unusually hot weather early in the season are apt to ripen the heads on the late-appearing stalks prematurely and before they have reached their full height. Nothing to betray that Bobs contains the blood of BSB has been seen in any of the growing plants since the first generation; and the matter continued to be a puzzle until last season, when what appears to be light was thrown on the matter from a new source. This I shall go on to explain. In 1902, it struck me that as so good a wheat as Bobs had then shown itself to be, had resulted from the crossing of the barley BSB on so rust-liable and relatively weak flour a variety as is M (F), a cross of this barley on one of the Fifes might give a still better wheat. Accordingly, I determined to have this cross made. The work of making it was performed by my assistant, Mr. J. T. Pridham. He operated on heads of several of the Fife varieties, using pollen of BSB on ten or twelve flowers of a head of each variety. Although the work was done under favourable conditions and not hurriedly and good pollen was secured, not one of the flowers he operated upon produced a seed. This, of course, was disappointing; but it did not astonish me greatly; because although an attempt to cross a rye on a wheat, which I had made many years previously, had given me two seeds which produced plants which were undoubtedly hybrids, several attempts which were made subsequently with other varieties of rye on other varieties of wheat had all resulted in failure. This had caused me to think that varieties of wheat differ in their readiness to take the pollen of rye or of different varieties of rye; and this I thought was probably the case, also, with varieties of wheat and the barley BSB. Fortunately, however, a cross of BSB on Fife wheats was not the only one that was attempted in 1902. The reciprocal cross of Fifes on BSB was also tried, and from the flowers which were operated upon seven seeds were secured. Most of these seeds were like the one which was obtained when BSB was crossed on the wheat M (F), in being small and pinched, but for all that I had little expectation of any of them turning out to be crossed seeds; for the operation

of crossing this barley is very delicate, while the difficulty of detecting whether self-impregnation has already taken place, when a flower is operated upon, is much greater than it is with wheat. These seeds, however, were carefully planted, and uncrossed seeds from the mother plant immediately adjacent to them in the next drill in the usual manner. I have already mentioned that the peculiarity of BSB is that its leaves are from the very first quite different from those of any wheat I know, in being broader and stiffer, and of a lighter green colour. In this case most, but not all, of the plants from the crossed seeds produced leaves which were entirely different from those of BSB, in being narrower, less stiff, darker, and altogether more wheat-like. So plain were these differences at the time, that I did not hesitate to imform some correspondents that we had succeeded in making this cross. These differences from BSB, however, gradually grew less and less; and by the time the plants began to shoot up, they could be observed no longer. Puzzling although this was, it gave me fresh confidence in the reality of the hybrid origin of Bobs. I therefore determined to apply a test which I considered likely to show me whether Bobs contained any of the blood of BSB. The test, which it occurred to me to apply, was of this nature. I have already given reasons for thinking that varieties of wheat differ in their ability to take the pollen of rye—that, in fact, some wheats have greater affinity for the pollen of rye, or of some ryes, than have others; and that the same reason probably accounts for the circumstance that while the barley BSB was able to impregnate the wheat M (F) it had failed with the Fifes. If this were the case, it seemed reasonable to expect that if half the blood of Bobs was BSB, that variety would have even greater affinity for the pollen of that barley than has its mother, M (F), only one flower of which, out of about a dozen which were operated upon, took its pollen; and still greater affinity than the Fifes which absolutely refused to be impregnated. This test, therefore, I applied to Bobs last season. The cross (Bobs x BSB) was made both at Lambrigg and Wagga—at the former by Mr. Pridham, and at Wagga, by my assistant there, Mr. R. T. Hurst; and at both places with all the success I expected; for at Wagga 18 seeds were obtained from crossed flowers, and at Lambrigg, where the work was done under unfavourable conditions, and too late in the season, five more were secured. It is of course unlikely that these 23 seeds, which have now been planted, will all produce crossbred plants; for in neither case were the precautions, which I should have considered necessary, taken to prevent self-impregnation. This, however, is not very likely to take place to any extent, at any rate, when the head is covered and tied up against impregnation from outside, as heads always are after they have been crossed. As three-quarters of the blood of those plants which are crosses will be BSB if Bobs is a hybrid, it scarcely seems possible that they will fail to show in some manner that they have in them the blood of BSB.

That the hybrids made by crossing BSB on the wheat M (F), and Fife wheats on BSB, should produce progeny which, in the first case appears to be entirely wheat-like, and in the second wholly like BSB, is not very remarkable in view of our knowledge that it is not very rare to find cases in which the external characteristics of the parents refuse to blend in their crossbred progeny. On this account it is apt to happen that the crossbred plants take entirely after one parent or the other in all external characteristics. In both of these cases an effort to blend appears to have been made in the generation which grew from the crossed seeds; in the



Menocher's No Core Apple. (Local).
Longitudinal Section, showing empty Seed Capsule and Calyx.



Spencer "Seedless" Apple with a Seed.
(Rural New Yorker).

former this effort could be seen throughout the generation, but in the latter it did not last so long. In the variable generation of the former cross no traces whatever of the BSB blood were detected, but the plants were more or less unlike in minor characteristics; what will happen in the variable generation of Fife wheats on BSB remains of course to be seen; and if there is any variability shown in the variable generation, it is difficult to conjecture what form the variations will take.

If the observations I have described have been accurately made and correctly interpreted, we have good reason for thinking that Bobs has in reality originated from a cross between the barley, BSB, and the wheat M (F). There are, however, several reasons for being uncertain about this. Bobs, as I have already mentioned, takes the infection of the wheat-bunt (*Tilletia fœtens*), very readily, while the experiments that I have made lead me to think that the barley BSB is absolutely proof against this bunt. Bobs, again, produces grain of considerably greater flour strength than does its mother M (F)*—that is to say, grain in which the proportion of the proteid glutenin to gliadin is presumably greater; for, so far as my own knowledge of wheats and their gluten goes, the proportion of glutenin to gliadin is in actual practice usually, and possibly invariably smaller than is necessary for the highest flour strength.† On the other hand, from what we know about the proteids of barley, there is likely to be nothing in the chemical composition of the grain of BSB to justify our expecting a greater proportion of glutenin to gliadin in the grain of a cross between it and M (F) than is found in M (F) itself, for besides albumen, a globulin, and a proteose, the only proteid (hordein) which, so far as I know, has yet been satisfactorily separated from the grain of barley, possesses the physical qualities of gliadin and not of glutenin,‡ while the impossibility of obtaining a coherent gluten from the flour of BSB shows that it does not contain, besides hordein, a proteid with the physical characteristics of glutenin. The separation and quantitative determination, however, of the proteids of wheat is in a very unsatisfactory condition. The subject, indeed, is one in which valuable work still remains to be done; but our present knowledge appears to me to justify what I have said on the subject. In addition to these reasons there is the fact, which I have already mentioned, that the grain of Bobs is, if anything, less like that of BSB than is the grain M (F). So much for the history and parentage of Bobs. The latter, however, cannot be regarded as being quite certain; but steps are being taken for throwing more light on the subject this season. In addition to BSB having been crossed on Bobs, Bobs has been crossed on BSB; but I hardly expect that this latter cross has been successful. BSB has also been crossed on some other wheats. If any of these crosses take, the plants will be kept under very close observation. A few seeds have been found and planted which were produced by the original plant of the BSB on M (F) cross. I hope, therefore, to be able to observe again the variable generation of the cross from which Bobs is descended. All these crosses are likely to provide objects of interest. It is

* The average (from six determinations) flour strength of Bobs, expressed in lbs. of bread, which can be made from 200lbs. of flour, is, as we have already seen, 302·5; while that of M (F), obtained from eight determinations, is 291·6. The difference, 10·9lb., is amply sufficient to show that the two varieties are not the same. The gluten contents of M (F), unfortunately, were not determined, so that a comparison between the two varieties in respect of this quality cannot be made.

† A circumstance, which has just come under my notice, appears to contradict this. The grain of the 1902 crop in Manitoba, although plump and fine-looking, disappointed the bakers. The matter was investigated, and the cause pronounced to be a deficiency of gliadin in the gluten.

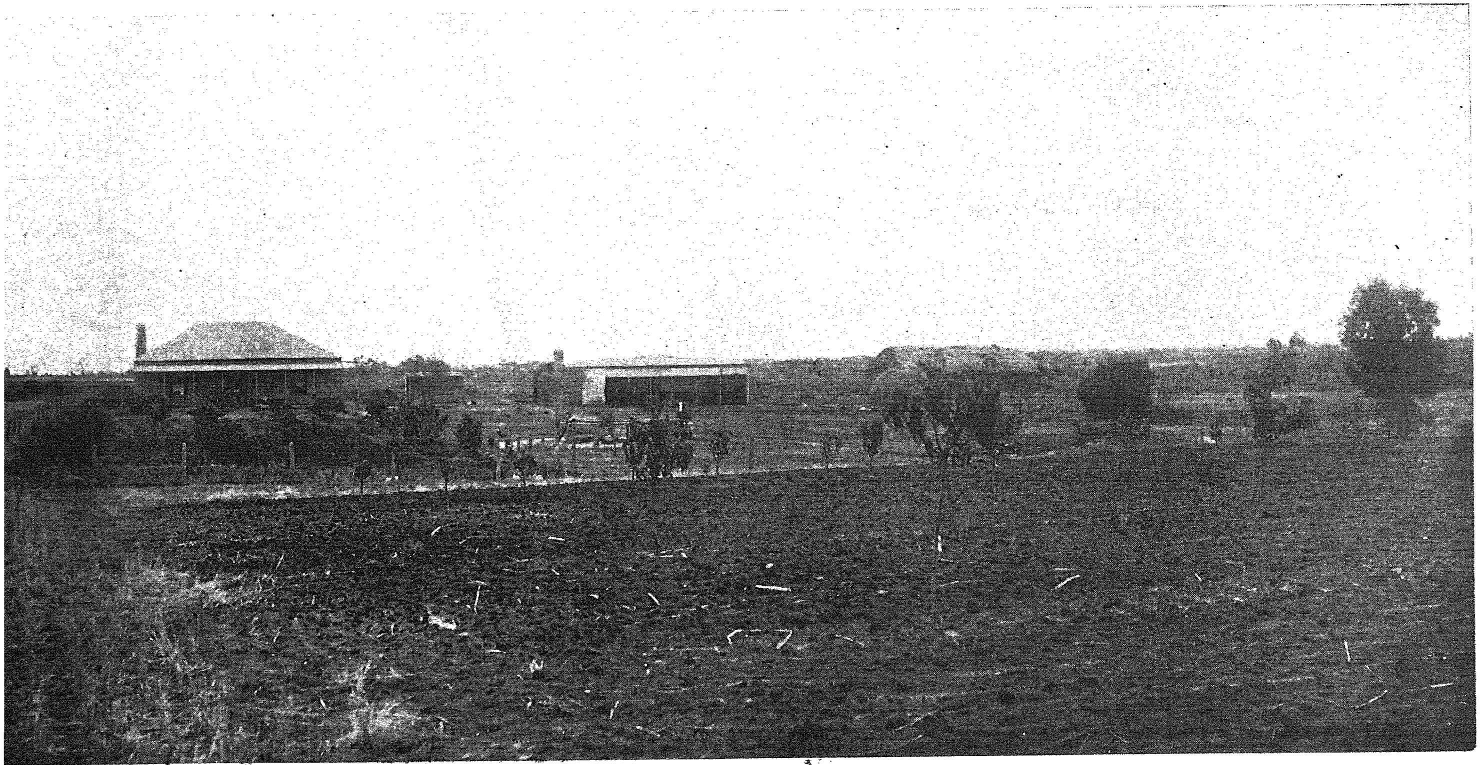
‡ T. B. Osborne, in Connecticut State Station Report, 1894. In "Notes on the Constitution of Wheat Gluten," by F. B. Guthrie (Misc. Publication No. 220 of our Department of Agriculture) much valuable information is given.

not a matter interest alone to ascertain whether Bobs really has the pedigree of M (F) x BSB, for matters of far-reaching importance may hinge upon it. If the effect of an infusion of BSB on the flour-strength of the crossbred, when other wheats are crossed, is the same as it has been with M (F), that is to say, if the effect which an infusion of its blood has had on the flour-strength of M (F) is a normal one, a means may have been discovered of making varieties of greater flour-strength than any we are at present in possession of, and that without so high a content of gluten as is necessary to give to the Fifes a corresponding flour-strength. Wheats of this class would be likely to be able to produce strong flour of good enough colour for the making of attractive bread, and would, on that account, not require to be mixed with other wheats either for the purpose, on the one hand, of increasing their flour-strength, or, on the other, of bringing the colour of their flour up to the mark. These wheats, in fact, would belong to the class of "straight flour" wheats—a class which, I believe, this country is specially capable of producing. Of course we have not yet facts enough in our possession to entitle us to expect to make this departure; but there are enough, I think, to justify our hoping and for our regarding it as not impossible. Again, if the plants which have resulted from the crossing of BSB with the pollen of Fife wheats, and have the appearance of pure barleys, are really hybrids, and if their Fife wheat parents have influenced the proteids of their grain, we may get varieties of barley with the habits, peculiarities, and adaptations of ordinary barley which will produce flour from which leavened bread can be made, and in this way grain suitable for the making of bread may be produced in places where wheat cannot be grown, and the world's supply of bread-making material considerably increased. This, of course, is only one of the things which are beginning to look to be not impossible. Also, if our barley-like plants are really hybrids, Fife wheats ought to take their pollen, and yield us progeny of greater promise than they would by being crossed with pure BSB. In dealing with "ifs" and "mights" and "woulds" in the manner I am now doing, I have of course left solid facts, and am giving play to imagination. Imagination, however, is a factor of considerable importance in efforts to secure progress, and in this case a glimpse of the possibilities we seem to have before us, even if they have only been imagined, may serve to make the work, which is going on, to be better understood and more interesting to some of our readers.—*Agricultural Gazette, N.S.W.*

NOTES ON THE CHAPMAN EXPERIMENTAL FARM.

By R. C. Baird.

The beginning of the month (May) was unfavourable for ploughing and other farm operations. The weather continued very dry up till the 12th, when a break took place. Heavy rain set in about 10 a.m. and continued all day, and up till the end of the month only two or three fine days are recorded.



MOUNT HARDY.

Wheeler Bros.' Farm. Holding, 648 acres; 390 acres cultivated; all fenced. A model homestead.

The country in general is looking fresh and green, the grass is growing splendidly, and a good winter for stock is assured.

Drilling was commenced about the middle of the month, and up to the present 75 acres of wheat have been drilled. The work was very much retarded by the continuous rains.

A patch of Cape barley and two patches of rape were sown during the month, to provide winter feed for the milch cows and the pigs. The rape crop, sown last month, is nicely above ground, and making good headway. I expect in a month's time to be able to put some sheep on it.

The potatoes planted last month are now above ground. Many of the sets have not germinated. I attribute this failure to the fact that the seed was received here too early—the beginning of February. Although they were kept in the coolest place available, the heat appeared to effect them so as to cause dry rot, and at the time of planting a large proportion were unfit for seed.

Lambing started about the middle of the month. The sheep are all in good condition, and, now that the young grass is springing up rapidly, should go on improving.

The pigs are living chiefly on melons, a little barley being fed to them once a day. During the month we have sold a number of young sows and one pure-bred boar, at satisfactory prices.

The recently-imported Dexters, consisting of one bull and two heifers, arrived safely at the farm. They are in nice healthy condition, and have taken kindly to their new quarters.

The poultry are looking well now. The Golden Wyandottes were the first to start laying. Of the Dorkings, only one has laid any eggs so far. I expect the others to start very soon. The White Wyandottes are very young, so I do not expect them to start laying for some time.

A start has been made with the erection of fencing round the new cultivation paddocks. This work will be proceeded with until completed.

Numerous inquiries for seed wheat have been received, and many sales have been effected, consignments being sent to all parts of the State.

[Ed. Note.—This report was received too late for publication in the June issue of the *Journal*.]

JUNE REPORT.

The past month, although somewhat deficient in rainfall, has been an excellent one for carrying out ploughing and sowing operations. Most of the farmers in this district have now completed cropping for the year, a larger area being put under crop than formerly.

During the month we have sown 40 acres of oats and 30 acres of wheat. Six new varieties of wheat and two new varieties of oats have been put in for trial. The total area sown to date is as follows:—Rape, 50 acres; 110 acres wheat, 40 acres oats. The new varieties of wheats are "Toby's Luck," "Australian Crossbred No. 100," "Plover," "White Lammas," "Lardcuts Blue," "Gallants Hybred." The new varieties of oats are "Golden Fleece," "White Siberian."

The rape crop sown in April is making good growth. In about a fortnight's time it will be sufficiently advanced to carry stock.

The potato crop planted in April is looking well, although owing to the hot weather having affected the seed before planting, there are a good number of blanks.

The crossbred ewes have now finished lambing, and I expect to mark a good percentage of lambs.

The Shrop ewes are now lambing.

The stock generally are in good condition for the time of the year.

Fencing is being carried on steadily. The fence around the new cultivation paddock is now completed.

Next month will see the completion of our cropping for the season. We have still about 20 acres to sow.

Ploughing will be carried on to prepare land for the summer crops.

The new orchard will be planted and fenced around with wire netting.

NOTES ON THE STATE FARM, HAMEL.

JUNE, 1905.

By G. F. Berthoud.

Weather.—Early in the month some heavy rains fell for a few days, followed by fine clear weather, mild days, and cold nights, with a few light frosts; on the whole, seasonable and favourable for farm work and growing crops.

Work.—The cereal plots are now all sown. These comprise small lots of many new and rare varieties of wheat, oats, barley, and rye. The early-sown plots are making strong, healthy growth. A large number of plots have been sown with various kinds of pasture grasses and fodder plants. This very interesting and valuable branch of the experimental work will be extended to include the culture and selection of indigenous grasses.

Orchard.—Area, four acres; planted in August last year, 400 fruit trees. These, with a few exceptions, consist of two of each kind, which comprise many of the newest and some of the best old tried varieties. When in bearing later on these should prove interesting to fruit growers for comparison, etc. Taken as a whole, the young trees have made strong and healthy growth. Only four died off in the summer.

Number of sorts as follows:—

Apples	54	Loquats ...	4	Pears	26
Apricots	10	Mulberries ...	3	Plums	5
Almonds	6	Medlar ...	1	Jap Plums ...	9
Cherries	4	Nectarines ...	6	Prunes	2
Chestnuts	5	Oranges ...	7	Quinces	7
Figs	9	Pecan Nut ...	1	Walnuts	2
Guava	1	Peaches ...	13		
Lemons	3	Persimmons ...	8		

INDIGENOUS PLANTS.—The flora of this State is remarkable for the large number of beautiful everlastings and other flowers, also a number of valuable grasses which are well worthy of systematic culture and possible improvement by careful selection. This work will lead on to useful results which are sure to benefit agriculturists and lovers of floriculture. For several years I have worked on this subject in a small way, and have met with fairly encouraging results. About eight years ago I collected seeds of fine grass, a Danthonia, on the Collie River. These I sowed here on a small plot within the railway enclosure. The plants are still healthy and good, although they are burnt off every summer and never manured since sowing. This grass is of good fattening quality for stock, and could be easily cultivated on a more extensive scale. By proper manuring it would prove to be a valuable addition in mixtures for permanent pastures. The kangaroo grass also does well under cultivation, forming fine strong plants, which remain useful and vigorous for many years. There are many other good grasses and fodder shrubs which could be successfully cultivated and adapted to the wants of the agriculturist. The Department of Agriculture desires to bring together all classes of useful wild grasses and flowers for trial culture on these plots. Will country residents kindly advance and help in this very interesting work, by collecting a few native seeds of any good grass or pretty flowers growing in their locality? The plants should be noted or marked when in bloom during spring, and the seeds gathered when ripe, usually during the months of November and December. The seeds should be enclosed in an envelope, bearing date of collection, height of plant, soil, if dry or wet, sand or clay loam; or any other useful notes to facilitate the work of culture here. I shall always be pleased to send useful seeds in exchange.

PASTURE GRASSES.

Lately several visitors have called here, and I also received many letters from farmers and others interested *re* the growth of good grasses and the best means of establishing successful permanent pastures. The question is rather a difficult one to answer correctly in all cases, owing to the great diversity of soils and local conditions of heat and moisture in this State.

Here numerous plots have been sown down with various grasses, and the intention is to keep on adding all likely useful kinds obtainable These will later on prove a valuable feature and interesting object lesson to visitors. I shall always be willing to give inquirers all information available on this subject, providing I know when they are coming. Many people are under the erroneous impression that good pastures can be successfully established on any poor soil, or dirty weedy land, worn out for cereals, etc. Such is not the case. Grasses require for a foundation a clean soil of fair quality well cultivated and liberally manured, and, above all, the young grass should be given a fair chance; say, at least six months after date of sowing, before live stock are allowed to feed on it. All progressive farmers should, if possible,

sow a few acres of grass each season, thereby annually increasing the value of their holding. But most people who go on the land are not very wealthy. My advice is to begin by sowing a small area; but do that thoroughly well. This will cost less and give more solid comfort than a large block badly done.

The land, if new or old, should be well and deeply ploughed early in spring; cultivated occasionally during the summer months to kill sorrel and other weeds. By doing so, the young grass will get a better chance of doing well. Sow early in autumn, from March to May, with a good selection of mixed grasses. If broadcast, at the rate of 30lbs. per acre; manure with fine bonedust, at the rate of not less than three cwts. per acre for our average soils. Most farmers, especially in the South-West, apply too little manure to obtain payable returns. Here, we get too much heavy rains in winter; these wash out the good or most soluble portions of the manure beyond reach of the young plant roots. The better plan would be to put in a smaller area, double the quantity of fertiliser, and fallow the balance of the block for use next season.

Plough into very narrow lands to ensure fair surface drainage. Sow early, not later than May, in any case. In laying down new pastures, it is of the greatest importance to start on a solid foundation, if we desire to obtain lasting results. In America, and also elsewhere, old pastures are often top-dressed with six cwts. of fertilisers per acre, which repays the farmer well. Poor grass land will never pay anyone. The fine-ground bonedust is the best to use in all cases, and, if desired, it may be mixed with superphosphates. Six cwts per acre is only a fair dressing; the cost for same is only £2 per acre.

When sowing broadcast, I always damp the bonedust or other fertiliser, and mix the seed with it. By doing so the seed will come up more evenly, and get a better share of the manure than if both are sown in a dry state, and is less liable to be blown about by the wind. As a general rule, the early morning is the best time for the work. Cover the seed by harrowing lightly, then roll to firm it down well.

In most cases mixed grasses will give the most profitable results. The following is a good mixture for the South-West and similar districts, costing at the rate of about 26s. per acre:—

8lbs. Cocksfoot	2lbs. Sheep's Burnet
6lbs. Timothy	2lbs. Rib Grass
2lbs. Tall Oat Grass	2lbs. *Paspalum dilatatum*
8lbs. Tall Fescue	

This should do well on all fair soils, and withstand considerable dry weather.

The following is well adapted for sheep and other stock, stands dry weather well, and should prove satisfactory on most soils. :—

	lbs.
Hard Fescue	6
Cocksfoot	8
Tall Fescue	5
Crested Dog's-tail	3
Sheep's Burnet	5
Paspalum dilatatum	2
Rib Grass	1

Cost about 28s. per acre.

Sheep's Burnet (*Poterium sanguisorba*).

For dry districts. I desire to draw the attention of all stockowners to the valuable qualities of this perennial herb, which roots deeply, gives plenty of nice foliage, is relished by all stock, shoots up again quickly after bush fires; will thrive well on most soils, including dry stony places. Plants sown here seven years ago are still vigorous and strong. Seed should be sown early in autumn, at the rate of 10lbs. per acre. Cost of seed, about 1s. per lb. in Sydney.

Bokhara Clover (*Melilotus alba*).

This valuable plant is indigenous to North Africa and Asia. Will give fair results on any well-drained soil, and even on stony ridges. The roots penetrate very deeply in the subsoil; therefore withstand the dry weather well. The whole plant bears a close resemblance to lucerne, but is taller and more shrubby. Will last for several years, and seeds fairly well in this climate. Sow early in autumn, at the rate of 10lbs. per acre. Usual price 1s. 6d. per lb. Good bee plant. Produces honey of excellent quality.

Falling Awn Grass (*Oryzopsis multiflora*).

Native of Madeira and the Canary Islands. A very good perennial grass; likely to prove of great value in our climate, as it grows naturally in the driest localities. Has given good results where tried in South Australia; seed obtainable in Adelaide in small packets, 1s. each. Seed plots of this and many other rare grasses are being cultivated here.

Paspalum dilatatum.

This handy perennial grass is a native of South America. The plants root down deeply, and providing that the soil retains a fair share of moisture during the summer months, it will produce a large amount of green feed of fair quality. Like all sub-tropical plants, it needs heat and moisture to bring it out to its full perfection. Seed should be sown very early in autumn or in spring; sow, if broadcast, at the rate of 8lbs. to 10lbs. per acre; cover very lightly. It germinates slowly unless the conditions are favourable.

Rhodes' Grass (*Chloris virgata*).

Native of Rhodesia, South Africa, where the climate conditions differs greatly from ours. There the winter months are usually dry and fine. The heavy rains fall during the hottest weather in summer. Therefore this grass is unlikely to do well in hot, dry places. On low moist or swampy soils it will give heavy yields of good green feed, greatly relished by horses. The frost does not damage it in winter. Propagated easily by dividing the runners, which root freely at every joint. Set out three feet apart each way, allowing a little fertiliser under each when planting. The seed is fine, and should be sown carefully in spring, cover lightly. Obtainable in Sydney, in packets, 1s. each. Several other varieties of Chloris will be grown here during the ensuing summer.

African Wonder Grass (*Panicum spectabile*).

Indigenous to tropical Western Africa. This really magnificent perennial grass is far famed for its bountiful production of succulent and fattening forage. In Fiji it runs over the soil at the rate of 10 feet in three months. Here, if planted six feet apart each way, on good low land, or on

the edge of brooks and swamps, it will do exceedingly well, covering the whole space with a thick mat of shoots in a few months; but it is unsuitable for culture in dry or cold places. Will not give good results without heat and moisture combined. Frosts cut back all young shoots, but do not injure the plant. Propagated easily by dividing the runners, which can be planted out in spring, like the Rhodes' Grass. Does not produce seed here.

NOTES ON THE EXPERIMENTAL FARM, NARROGIN.

By Frank L. Faulkner.

I beg herewith to submit my report of the farm for the month of June, 1905:—

June, in this district, opened out wet, but the latter three weeks of exceptionally fine weather have been very favourable to the farmers. Men and horses have consequently been kept going at high pressure. There is, however, a large acreage that will have to be left untouched, not having recovered from the wetting received in May. On this farm we have had to abandon the idea of putting in about 35 acres to winter cereal. It is very good summer country, however, and as soon as the ground dries and the weather warms sufficiently it will be sown to maize, sorghum, millet, etc.

The 40 acres of rape has made very little headway during the month, and is showing effects of the frost. It is covering the ground though, and will give us a lot of feed as soon as the weather warms.

We have managed to get 185 acres under winter cereal, and the earlier sown is beginning to show up well. About 25 acres is ploughed and well worked, ready to receive peas, grasses, lucerne, paspalum, and potatoes. About four acres of nice black redgum sand is being reserved for potatoes; an acre or so of lucerne will be tried on similar country, and what paspalum roots we have will be also planted out on land of a similar class.

We have already sown trial plots of three varieties of field peas, each variety being tested with and without the nitrogen fixing culture of bacteria received from the Department of Agriculture, U.S.A. Further tests of this culture will be made, and we intend to test the efficiency of (1) dipping the seed in the prepared liquid, and (2) inoculating soil and spreading it over the crop as a top-dressing.

Our wheat crop is made up largely of the varieties sown last year, those giving the best results being sown on a larger scale. In addition to this, a trial plot of each of the best wheats that I could procure—with others to make interesting comparisons—have been sown side by side on an even-class piece of land, and with similar treatment and manuring. This test will be a reliable comparison of the adaptability of the various varieties to the conditions of our district.

A few of the best varieties of oats and rye procurable have also been sown similarly.

The month has practically finished what has been a very severe seeding for the horses. We shall now endeavour to rest them as much as possible, but have still a good deal to do in the orchard, in getting in the smaller lots of crops and in preparing the land for fallow and summer crops.

During the month we have been well supplied with vegetables, and have harvested part of a patch of potatoes set in March.

The weather has been very cold, however, and on the whole vegetables have moved very little. We have a fine lot of all kinds set out, and with the advent of a little warm weather they should come well.

The stock are all barely holding their own on the pasture, but with the aid of a little chaff and silage the cattle are doing fairly well. The cows in milk are receiving the same diet, with the addition of some bran. Thirty-three weaners and slips have been turned out on the rape, and are doing splendidly. A brush-and-straw shelter has been made for them in a thicket near by, and a dish of corn brings them to camp every evening.

The older pigs are in good breeding condition, and three good litters have just been farrowed.

The fowls are laying shyly, the Silver Wyandottes doing much better than either the Plymouth Rocks or the White Leghorns.

The sheep have now practically finished lambing, and tailing and marking will be a job for the next spell of fine weather. The lambs are strong and healthy, and the ewes in fair condition, but not fat. The hoggets and all dry sheep are in good strong condition for the winter. We have just received the material for building a weather-break for the Angora goats. This construction will be completed as soon as possible, as the goats suffer here from the excessive rain.

During the month I procured four common goats (does) from a neighbour, for the purpose of crossing and breeding up grade flocks with the Angora. £25 has been voted to this farm for the above purpose, and I would be glad to know where we could procure more common does. I am convinced that the grade Angora bred up from the common doe will adapt itself to our southern districts better than the pure Angora. I have just received parts for the second-hand oil-engine received last month. This machine, although very much out of order and not so handy for a farmer as a steam-engine, is certainly a great improvement to the powers tried here previously, *i.e.*, the horse treadmill and the wind-motor.

In referring to the crops, I omitted to say that we have 25 comparative manure plots, each plot being on, as far as possible, even land, with the same wheat, and, with the exception of the manuring, under similar conditions. In these plots all the chief manurial constituents, alone and in different combinations and quantities, are represented. For succeeding seasons I shall endeavour to obtain and fence off an even-quality piece of land to be used every year for manurial experiments. By this means the effect of continuous manuring with the different elements and combination of elements, respectively, will be shown.

THE GOVERNMENT LABOUR BUREAU.

HALF-YEARLY REPORT.

Mr. J. B. Hitchins, the Acting Superintendent of the Government Labour Bureau, has forwarded to the Minister for Labour the following report:—

PERTH.

Registrations.—The total number of men who called during the month of June in search of work were 769. Of this number 403 were new registrations, and 366 renewals—*i.e.*, men who called who had been registered during the year prior to the month of June. The trades or occupations of the 709 applicants were as follow:—Labourers, 227; handy men, 70; farm hands, 52; handy lads, 45; bushmen, 40; cooks, 39; carpenters, 25; painters, 24; drivers, 22; hotel hands, 17; clerks, 15; yardmen, 13; gardeners, 12; grooms, 10; blacksmiths, 9; kitchenmen, 8; miners, 7; engine-drivers, bakers, carpenters (rough), fitters, and barmen, 6 of each; grocers, stewards, station hands, plasterers, and wheelwrights, 5 of each; bricklayers, plumbers, waiters, coachmen, butchers, orchardists, sawmill hands, and orderlies, 4 of each; and 47 miscellaneous.

Engagements.—The engagements for the month numbered 181. The classification of work found was as follows:—Labourers, 76; bushmen, 18; farm hands, 16; handy men, 13; handy boys, 12; boys for farms, 7; woodcutters, 6; carpenters, 4; kitchenmen, 4; cooks, 3; gardeners, 9; yardmen, 3; drivers, 2; engine-fitters, 2, plumbers. 2; and 10 miscellaneous.

FREMANTLE.

Registrations.—The applicants for work numbered 395. There were 305 new registrations and 90 renewals.

Engagements.—There were 57 engagements, classified as follows:—Labourers, 52; handy men, 2; bushmen, dairymen, and farm hands, 1 of each.

The female servants who called numbered 12. There were no engagements.

KALGOORLIE.

Registrations.—There were 129 new registrations and 42 renewals.

Engagements.—The engagements numbered 13, classified as follows:—Handy men, 3; carpenters, 2; engine-drivers, 2; blacksmiths, clerks, cooks, gardeners, handy youths, and labourers, 1 of each.

The female servants who called numbered 69. There were 42 new registrations and 27 renewals. The engagements were 5, viz.:—Generals, 3; cooks, 1; and useful girls, 1.

CUE.

There were two applicants for work, and no engagements.

Women's Branch, Perth.

Registrations.—There were in connection with the Women's Branch, Perth, 130 new registrations and 97 renewals. The classification was as follows:—Generals, 34; housemaids, 33; light generals, 29; housekeepers, 29; cooks, 27; waitresses, 20; laundress-charwomen, 19; useful girls, 17; cook-laundresses, 5; ladyhelps, 4; nursemaids, 4; kitchenwomen, 2; pantry-maids, laundry-housemaids, married couples, and nurse-needlewomen, 1 of each.

Engagements.—The engagements numbered 77, classified as follows:—Generals, 17; laundresses, 16; light generals, 10; useful girls, 10; cook-laundresses, 7; charwomen, 3; ladyhelps, 3; housemaids, 3; house-parlor-maids, 2; kitchenmaids, housekeepers, pantrymaids, waitresses, laundry-housemaids, and nursemaids, 1 of each.

General Remarks.

At the central office, Perth, 769 men called during June. This total is 91 short of the number for May, and 58 in excess of that for June last year. The engagements numbered 181, this being 91 short of the number for May, and 15 short of that for June last year.

The number of individual men who applied for work at Perth from 1st January to 30th June, 1905, was 3,332, as against 2,843, or 489 more than for the corresponding six months of last year. The number of callers at the Bureau cannot be taken in itself as a gauge of the condition of the labour market. A large number of individuals (including new arrivals) call at the Bureau for the purpose of obtaining information, and after registration are not again seen. The engagements for the half-year were 1,356, as against 1,245, or 111 more than for the same period in 1904. Of the engagements, 1,221 were by private persons, and 135 were from Government departments. At the women's branch, the females who called numbered 878, as against 868 for the same period of last year. The engagements were 544, being 90 in excess of the total for the first six months of last year, which was 454. At Fremantle the registrations were 1,330 and the engagements 158, being 575 and 14, respectively, in excess of the total for the same period of last year. The females who called at this office numbered 131, and the engagements 24 for the half-year. At Kalgoorlie the registrations were 676 and the engagements 114, being 218 and 53, respectively, in excess of the total for the first half-year of 1904. The women who registered numbered 154, and the engagements were 10.

Condition of the Labour Market.

The following is an abstract of reports received from magistrates, police officers, secretaries to labour organisations, and others:—

Perth.—During the past six months there has been an over-supply of workers of almost all description. As far as the building trade is concerned, employment has been good, and until lately few of this class have been out of work. There are a number of good unskilled labourers out of employment.

Yilgarn (Southern Cross).—There has been little demand for labour in this district except for building trades. The outlook for the next six months does not foreshadow any demand.

Coolgardie.—Workers find it difficult to procure employment, and present prospects do not point to improvement.

Coolgardie East (Kalgoorlie and Boulder).—A good demand has existed for bricklayers, otherwise the market has been somewhat glutted, without apparent improvement in the immediate future.

Coolgardie North-East (Kanowna).—The supply has been equal to the demand, and present prospects do not point to a change.

Coolgardie North (Menzies).—The labour market has been quiet. A number of navvies were employed at the Menzies Dam excavation, but no other work has been started. Any unemployed find their way to Kalgoorlie and other large centres.

Broad Arrow.—There has been little demand for building trades, and none for unskilled labour. Mining has also been dull, and miners who before could always find work on mines are now prospecting for themselves.

Yalgoo (Yalgoo, Wolla Wolla, Wurarga).—The demand for any class of labour has been small, but from present prospects there promises to be little activity in mining during the remainder of the year. Some of the pastoral lessees are also fencing their holdings.

Murchison (Nannine, Cue, Day Dawn, Mount Magnet).—Generally in the district the supply has exceeded the demand. At Day Dawn there have been a number of unemployed, chiefly surface labourers and hammer-and-drill men, though generally there are fair chances of good machine miners obtaining work. At Nannine the demand has been greater than formerly, but has not exceeded the supply; there has been an influx of alluvial miners, Jillawarra being the principal attraction. Numbers have passed through Nannine *en route* to Barrambie, and to employment on the rabbit fence. Prospects point to present demand being maintained.

Mount Margaret (Morgans, Malcolm).—The supply in all classes of labour has been sufficient to meet the demand; the present prospects are good.

Peak Hill.—The demand has not exceeded the supply, nor is there at present any prospect of improvement.

Victoria (Dongarra, Greenough, Geraldton, Mingenew).—The labour market on the whole has been very quiet, with no prospect of improvement. The district generally being agricultural, there is no demand but for good farm labourers, for whom there is some request. A good season is anticipated from the early rains.

Toodyay (Toodyay, Newcastle, Moora).—The supply in all classes is sufficient. There is no likelihood of the labour market being much altered during the next six months.

Northampton.—There has been demand for good farm hands, some farmers having to do their own work. Land in this locality is rapidly being taken up, and is reported to be very rich. Considerable quantities of potatoes are being put in, while tomatoes promise to become a great industry, they coming in earlier in this district than in other parts of the State.

Northam (Northam, Meckering, Doodlakine).—The condition of labour has been fairly good. Throughout the district there is some demand for agricultural workers.

York (York, Beverley).—A demand exists for agricultural labourers.

WELLINGTON (Bunbury, Donnybrook, Yarloop).—At Bunbury, agricultural labourers and female domestic servants have been in fair demand. Market for unskilled labour is overstocked. Tradesmen in the building line are sufficiently plentiful, and in other trades supply exceeds demand. Employment at Donnybrook has been dull for other than sleeper hewers, who have had good work. There is very little demand for labour of any kind at Yarloop, owing to the uncertainty existing in the timber industry.

COLLIE.—Owing to the uncertainty hanging over coal mining, the staple industry of the district, the labour market has been depressed for the past six months, with no immediate prospect of improvement.

SUSSEX (Busselton).—Labour has been dull, with little prospect of improvement.

BLACKWOOD (Bridgetown, Greenbushes).—There has been for the past six months some demand for building trades, many shops and buildings being erected in Bridgetown. There exists a demand for reliable farm hands, as also for female servants.

PLANTAGENET (Albany).—While the mallet mills were in full operation there was a fair demand for labourers. Now the mills are closed, a number of men are seeking employment.

WILLIAMS (Narrogin).—The starting of the Narrogin-Collie line has employed a number of labourers. There is some demand in the building trade.

KATANNING (Katanning, Wagin Lake, Broome Hill).—The labour market for the past six months has been rather overstocked, and no improvement in the near future is anticipated.

ESPERANCE.—The supply of all kinds of labour has been in excess of the demand. There is no immediate prospect of a change.

ABORTION AMONGST MARES.

By R. E. WEIR, M.R.C.V.S.

With regard to abortion amongst mares in the Greenough and Geraldton Districts; this matter was brought to my notice some twelve months ago, and the opinion then formed, as to the probable cause, was that a faulty condition existed in the pasture on which the animals had been grazing, but without a special investigation being made it was impossible to state definitely how it was produced.

Some further light has been thrown on the matter by the report of the farm manager, at Chapman, advising that a few of last year's foals were malformed at birth, and as this resulted from a want of lime in the constituents of the food supplied to the mares, it is possible that some connection may exist between both complaints. A deficiency of lime in the food supply, together with the extremely rapid growth of pasture in spring may account

for the trouble, and should this theory prove correct the matter may easily be overcome by careful management. For instance, all brood mares which are in the habit of being used for the farm work require to be kept at steady chain work practically up to the time of foaling, and two feeds (morning and night) of chaff, oats, and bran should be provided, the mid-day meal to consist of grass alone. In this way the mares should be kept in good health, and the constituent elements necessary for the proper nourishment of the young provided.

Where impossible to treat in this manner, the difficulty may be overcome by removal to different pasture for a few months before foaling, or by artificially feeding in the paddocks, and by supplying a daily allowance of bone meal and salt. The pasture itself may be improved upon by direct application of lime and phosphates.

SHOULD WE BREED DONKEYS?

As illustrating the difference in the position the lowly donkey or ass holds in Australia and in America, the following particulars of a sale of jacks and jennets held recently in America, when fifty-nine animals, the property of the Limestone Vale Farm, were sold by auction, are given :—

These included twenty-nine jacks and thirty jennets. The average for the whole lot was £96 10s. The top price was 280gs. for a jack foaled in 1901, and the twenty-nine averaged only a little short of £150. Jennets made up to 170gs., and averaged about £45. Taking these figures altogether, it would require a very good lot of horses in this country to make the same money. It is evident from the remarks of the *Breeders' Gazette*, from which we quote these figures, that this was an exceptional sale, but still the value of breeding donkeys is striking enough. Our contemporary says:—"It was a square deal auction from start to finish. Every known defect of the animals was mentioned by the proprietors before the auctioneer asked for bids. Every animal in the catalogue was sold." Whether these defects refer only to unsoundness or to structural defects and vices we know not, but we can hardly imagine a horse-owner or any other owner in this country pointing out to intending exhibitors the faults of their animals. There seems, however, to be a moral in this sale, for it is also mentioned that the sale was conceded to be the most successful public sale of this class of stock ever held in Missouri. It would be a distinct innovation to hear before an auction in this country some such announcement as this: "Gentlemen, lot 1, as you may observe, is an oldish mare. She may or may not breed again, but it really does not matter much. She has bred a few things—mostly weeds, which never paid the service fee and their board. You may also observe that her feet are none too good, but she is well provided with side-bone, and that splint is fairly prominent. Her wind might be better. She is much too narrow, and looks much like a gelding at the head. You should also notice that her action leaves something to be desired. I might mention, however, she is particularly active when anyone is within striking distance of her heels, and there are one or two other trifles, such as crib biting, etc. Now, gentlemen, start me."—*The Farmer and Stockbreeder.*

WEST AUSTRALIAN MINERAL PRODUCTION.

The Statist, Department of Mines, has provided the *Journal* with the following table of returns of the Gold Production of Western Australia from 1st January, 1886, to 30th June, 1905:—

GOLD.

GOLD PRODUCTION OF WESTERN AUSTRALIA FROM 1ST JANUARY, 1886, TO 30TH JUNE, 1905.

Year.	Grand Total. Export.	Mint.	Total.	Value. £	s.	d.
	Fine ozs.	Fine ozs.	Fine ozs.	£	s.	d.
1886	270·17	...	270·17	1,147	12	2¼
1887	4,359·37	...	4,359·37	18,517	8	6¼
1888	3,124·82	...	3,124·82	13,273	7	10
1889	13,859·52	...	13,859·52	58,871	9	11¾
1890	20,402·42	...	20,402·42	86,663	19	5¼
1891	27,116·14	...	17,116·14	115,182	0	10
1892	53,271·65	...	53,271·65	226,283	11	8½
1893	99,202·50	...	99,202·50	421,385	8	8½
1894	185,298·73	...	185,298·73	787,098	19	6
1895	207,110·20	...	207,110·20	879,748	4	2¼
1896	251,618·69	...	251,618·69	1,068,808	5	2
1897	603,846·44	...	603,846·44	2,564,976	12	9¼
1898	939,489·49	...	939,489·49	3,990,697	13	10
1899	1,283,360·25	187,244·41	1,470,604·66	6,246,731	10	7¾
1900	894,387·27	519,923·59	1,414,310·86	6,007,610	13	4½
1901	923,686·96	779,729·56	1,703,416·52	7,235,653	9	1
1902	707,039·75	1,163,997·60	1,871,037·35	7,947,661	9	7¾
1903	833,685·78	1,231,115·62	2,064,801·40	8,770,718	17	0¼
1904	810,616·04	1,172,614·03	1,983,230·07	8,424,225	17	3¾
Total	7,861,746·19	5,054,624·81	12,916,371·00	54,865,256	11	9
1905†	338,251·01	627,123·15	965,374·16	4,100,648	15	7¼
TOTAL	8,199,997·20	5,681,747·96	13,881,745·16	58,965,905	7	4¼

† 30th June.

MINERALS OTHER THAN GOLD.

Latest available Return (to 30th June, 1905) of Ore and Minerals, other than Gold, showing the Quantity produced and the Value thereof, as reported to the Mines Department from the respective Goldfields and Mineral Fields during 1905 and previous years.

Year.	Month.	Copper Ore.											
		Day Dawn D.		Mt. Malcolm D.		Northampton Mf.		Phillips River Gf.		West Pilbarra Gf.		Total.	
		Quantity	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
		tons.	£	tons.	£	tons.	£	tons.	£	tons.	£	tons.	£
Previous to 1899	...	...	...	...	...	...	...	...	...	7,018·00	55,270	7,018·00	55,270
1899	...	...	...	273·00	4,338	136·00	2,122	...	...	2,555·00	29,478	2,964·00	35,938
1900	...	5·15	91	4,539·00	30,718	...	...	34·00	725	1,605·00	12,139	6,183·15	43,673
1901	...	10·50	76	7,660·00	40,738	38·50	277	1,089·14	12,918	1,162·00	15,891	9,960·14	69,900
1902	...	...	...	1,954·00	6,852	...	...	308·25	1,238	...	...	2,262·25	8,090
1903	...	...	...	18,965·00	45,557	...	...	1,561·33	10,984	...	...	20,526·33	56,541
1904	...	...	...	500·00	900	...	...	3,468·89	24,280	...	...	3,968·89	25,180
	Total ...	15·65	167	33,891·00	129,103	174·50	2,399	6,461·61	50,145	12,340·00	112,778	52,882·76	294,592
1905	January ...	...	...	...	...	...	...	104·11	698	...	...	104·11	698
Do.	February ...	...	...	...	...	...	...	165·71	1,109	...	...	165·71	1,109
Do.	March ...	...	...	...	...	...	...	394·07	2,405	...	...	394·07	2,405
Do.	April ...	...	...	...	...	...	...	252·85	1,707	...	...	252·85	1,707
	Total ...	15·65	167	33,891·00	129,103	174·50	2,399	7,378·35	56,064	12,340·00	112,778	53,799·50	300,511

MINERALS OTHER THAN GOLD—*continued.*

Year.	Month.	Ironstone.						Lead Ore.		Silver Lead Ore.	
		West Pilbarra Gf.		State generally.		Total.		Northampton Mf.		Ashburton Gf.	
		Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
		tons.	£	tons.	£	tons.	£	tons.	£	tons.	£
Previous to 1899 ...	...	100·00	300	...	...	100·00	300	...	...	...	...
1899	...	...	...	12,852·00	8,939	12,852·00	8,939	82·75	912	...	...
1900	...	...	...	12,251·00	9,258	12,251·00	9,258	268·00	533	...	...
1901	...	...	...	20,569·00	13,246	20,569·00	13,246	...	...	21·05	152
1902	...	...	...	4,800·00	2,040	4,800·00	2,040	...	...	35·85	277
1903	...	...	...	220·00	88	220·00	88	...	...	...	...
1904	...	...	...	1,441·50	577	1,441·50	577	...	...	...	...
	Total ...	100·00	300	52,133·50	34,148	52,233·50	34,448	350·75	1,445	56·90	429
1905	January ...	...	...	...	...	...	...	...	...	...	...
Do.	February ...	...	...	...	...	...	...	...	...	...	...
Do.	March	...	..	1,308·60	523	1,308·60	523	...	...	...	...
Do.	April	...	...	...	...	...	...	...	...	...	...
	TOTAL ...	100·00	300	53,442·10	34·671	53,542·10	34,971	350·75	1,445	56·90	429

MINERALS OTHER THAN GOLD—*continued.*

Year.	Month.	Coal.		Limestone.						Diamonds.	
		Collie River Coal Mf.		Yilgarn Gf.		State generally.		Total.		Nullagine D.	
		Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
		tons.	£	tons.	£	tons.	£	tons.	£	carats.	£
Previous to 1899...	...	3,508·00	1,761	...	...	...	...	...	...	...	...
1899	...	54,336·00	25,951	...	...	17,593·00	2,838	17,593·00	2,838	*	24
1900	...	118,410·10	54,835	269·85	273	15,657·00	3,321	15,926·85	3,594	...	...
1901	...	117,835·80	68,561	1,642·00	919	16,568·00	3,429	18,210·00	4,348	...	...
1902	...	140,883·90	86,188	535·00	340	4,545·35	1,000	5,080·35	1,340	...	...
1903	...	133,426·62	69,128	102·00	75	1,177·50	103	1,279·50	178	...	...
1904	...	138,550·04	67,174	...	...	13,397·20	1,699	13,397·20	1,699	...	...
	Total ...	706,950·46	373,598	2,548·85	1,607	68,938·05	12,390	71,486·90	13,997	...	24
1905	January ...	6,773·90	3,376	...	...	...	...	...	...	...	...
Do.	February ...	8,162·50	4,061	...	...	...	...	...	...	...	...
Do.	March ...	11,478·22	5,433	...	...	2,783·60	418	2,783·60	418	...	...
Do.	April	11,026·45	5,304	...	...	...	...	...	...	...	...
	TOTAL ...	744,391·53	391,772	2,548·85	1,607	71,721·65	12,808	74,270·50	14,415	...	24

NOTE.—As the collection of Statistics of Minerals other than Gold commenced during 1899, the total Production from the different localities can only be approximately estimated by the Customs Records, the latest available returns of which are to be found in Table XXI., pages 96-99, of the Annual Mining Statistics of the Department of Mines for the year 1903. * Weight unknown.

MINERALS OTHER THAN GOLD—*continued.*

Year.	Month.	Black Tin. Greenbushes Mf. Quantity.	Greenbushes Mf. Value.	Marble Bar D. Quantity.	Marble Bar D. Value.	Total. Quantity.	Total. Value.
		tons.	£	tons.	£	tons.	£
Previous to 1899 ...	...	1,590·33	66,108	75·45	4,419	1,665·78	70,527
1899 ...	...	277·32	21,658	57·50	3,612	334·82	25,270
1900 ...	...	435·62	29,528	387·87	27,174	823·49	56,702
1901 ...	...	321·34	18,852	412·98	21,148	734·32	40,000
1902 ...	...	403·21	24,680	216·35	15,103	619·56	39,783
1903 ...	...	524·94	34,362	292·11	21,528	817·05	55,890
1904 ...	...	533·64	34,462	320·86	24,355	854·50	58,817
	Total ...	4,086·40	229,650	1,763·12	117,339	5,849·52	346,989
1905 ...	January	29·25	2,078	27·60	2,021	56·85	4,099
Do. ...	February	54,78	3,913	21·45	1,545	76·23	5,458
Do. ...	March ...	54,45	3,999	29·35	1,972	83·80	5,971
Do. ...	April ...	44,65	3,569	40·85	3,047	85·50	6,616
	Total ...	4,269·53	243,209	1,882·37	125·924	6,151·90	369,133

SCIENCE AND AGRICULTURE.

VALUE OF BEES AS PLANT FERTILISERS.

Professor Benton, the expert apiarist at the United States Department of Agriculture, in reply to an inquiry as to the actual use and practical utility of bees in the fertilisation of fruits, clovers, and other plants, gives the following reply:—

"Many of our common varieties of plants are easily pollinated and perfect fruit result when free access is given to honey bees; whereas when the visits of the bees are shut off, either no fruit, or at least very imperfect fruit, results. For example, in a series of experiments tried at the Michigan Experiment Station, 40 blossoms, covered so that bees could not reach them, produced no apples, while 40 blossoms uncovered produced 15 apples; 140 pear blossoms, covered, produced no fruits; 140 uncovered produced seven; 300 cherry blossoms covered, nine fruits; uncovered, 119 fruits; red clover, 10 heads covered, no seeds; 10 heads uncovered, 191 seeds; white clover, 10 heads covered, no seeds; 10 heads uncovered, 541 seeds.

"The celebrated naturalist, Charles Darwin, has referred to the importation of bees in the pollination of clovers. Crimson clover flowers, which

were visited by the bees, produced between five and six times as many seeds as those which were protected by a net so that the bees could not visit them. With the common red clover his experiments showed that 100 flower heads on protected plants did not yield a single seed, while an equal number on plants to which the bees were given access yielded 2,720 seeds. In the case of common white clover, the cross-pollinated blossoms yielded ten times as many seeds as those that were protected from insect visits. A second experiment with the same plant gave 2,290 seeds from 20 clover heads, while a corresponding number protected from the bees had but a single seed, and that an aborted one.

"Numerous other instances could be cited having a similar bearing. Such experiments are very easy to repeat One does not need to accept the results of another's work, however carefully the latter may have been done, or what reputation for accuracy and honesty in investigation the experimenter may bear. It is my belief that bees are of very great value in the cross-pollination of vast numbers of our most useful farm crops, and experiments which have been conducted at this department have led us to plainly state in an official publication that in the case of many of our commonest fruits it is of the utmost importance to have sufficient bees in the neighbourhood to properly go over the blossoms, and that orchards should be so located that they are sheltered, and insect visits thus encouraged."—*American Agriculturist.*

POTATOES.

The potato is undoubtedly the most useful vegetable for household food produced, not only in Australia, but throughout the civilised world. In support of this contention, Mr. Robt. E. Turnbull, writing in a recent issue of the *Agricultural Gazette* (England), says:—

In every house and cottage in Great Britain potatoes are in daily use, whilst in Ireland this valuable vegetable forms the staple of a considerable portion of the rural population.

In Great Britain the average quantity of potatoes consumed annually per head of the population is about 2cwt., or half a ton per family of five persons. In Ireland the average consumption is about 8cwt. per head, or 2 tons per family. The total quantity of potatoes used for household food in the United Kingdom in 1904 was about 5,640,000 tons, or rather more than $2\frac{1}{2}$cwt. per head.

The official agricultural returns for Great Britain unfortunately do not include crops grown on holdings that are one acre or less in extent; the quantity of potatoes produced annually in this country is, therefore, much larger than the agricultural returns indicate. According to the returns 6,230,000 tons were grown in 1904, viz., 3,588,000 tons on holdings of over

one acre in Great Britain, and 2,642,000 tons in Ireland. The average yield per acre in Great Britain was nearly $6\frac{3}{10}$ tons, and in Ireland over $4\frac{1}{4}$ tons. The average per acre for the whole Kingdom was about $5\frac{1}{4}$ tons. This yield per acre has seldom been exceeded; in point of quality the crop was one of the best in most places that has ever been experienced. In Scotland the average yield was rather more than $7\frac{1}{8}$tons per acre. This average has never before been equalled either in Scotland or England. The value of the wheat harvested last year in the United Kingdom was about £7,000,000. The value of the potatoes grown in Ireland, and on holdings of over one acre in Great Britain, was about £20,000,000. Including straw the value of the wheat crop was only about £10,000,000.

In the 10 years, 1894-1903, the average yield of potatoes per acre in Great Britain was $5\frac{3}{4}$ tons; in Ireland the average yield was $3\frac{5}{6}$ tons; the average yield for the whole Kingdom was about $4\frac{7}{10}$ tons. In the 10 years, 1885-94, the average yield per acre in the United Kingdom was under $4\frac{1}{2}$ tons (4·47). The average in Ireland only slightly exceeded $3\frac{1}{2}$ tons. The difference in yield between a favourable and an unfavourable season is far greater in potatoes than in grain. In Ireland the difference is very marked. In 1897 the crop in that country only averaged about $2\frac{1}{5}$ tons per acre, whereas in 1901 the average was $5\frac{3}{10}$ tons.

In Great Britain, the Isle of Man, and the Channel Islands, the area under potatoes was 8·44 per cent. less in 1904 than in 1871, although the population was greater by about $12\frac{1}{4}$millions, or by nearly 47 per cent. In Ireland the area under this crop in 1904 was nearly 440,000 acres, or over $41\frac{1}{2}$ per cent. less than in 1871. The population was less by over one million, or by 18·7 per cent. The population of the United Kingdom in 1904 was greater than in 1871 by 35·7 per cent., but the area under potatoes was less by 29·14 per cent. In 1871 the potato crop occupied about 1,694,000 acres. In 1904, on holdings of over one acre, the area planted was 1,200,400 acres, or nearly 500,000 acres less than in 1871.

The competition from abroad is not seriously felt by potato growers in this country. In the five years, 1898-1902, the average quantity imported into the United Kingdom was only 335,975 tons, of which 58,734 tons came from the Channel Islands. In 1900, owing to the short supply of home-grown potatoes, the quantity imported was 445,550 tons, and in 1903, from the same cause, the quantity imported was also comparatively large, viz., 457,510 tons. In the five years, 1893-97, the average quantity imported from abroad and the Channel Islands was only 154,560 tons.

The grower who has a market close at hand has a great advantage in the sale of early potatoes over other growers, because his produce can be placed on the table of the consumer whilst it is still fresh. New potatoes decline in value every hour after leaving the ground. The country labourer who has a productive garden attached to his cottage, and can have his potatoes cooked as soon as they are dug up, enjoys an advantage that people who reside in cities seldom experience.

The potato was brought to this country from Virginia in 1586 by Sir Walter Raleigh, and was by him "cherished and cultivated for food" on his estate at Youghall, near Cork. Sir Robert Southwell "informed the Fellows of the Royal Society, December, 1693, that to succour the starving, when the civil wars had devasted the corn crops, his grandfather first cultivated potatoes in Ireland, and that he had them from Sir Walter Raleigh" (Earl Cathcart). Gerard (1597), who was an enthusiastic potato

grower, wrote in his Herball: "I laboured with the soil to make it fit for the plant, and with the plants to make them delight in the soil in order that they might prosper as in their native country." The potato grows wild both on the mountains of Central Chili and in the forests of the Chonos Archipelago, where it was seen by Darwin in 1835. The potato was first extensively cultivated in Ireland in 1610, and in Lancashire in 1684 (H. Stephens).

The author of "The Modern Farmer's Guide" (R. and A. Foulis, Glasgow, 1768), who was a keen observer and a thoroughly practical farmer, found a substantial profit in growing potatoes as a fallow crop in Ireland, where a profit of nearly £6 per acre was obtained. He wrote: "Potatoes may be sown upon land that is intended for summer fallow, and such land will absolutely receive more benefit from this potato fallow than if nothing had grown; for what with hoeing, ploughing, and the tops smothering the weeds, the ground is made clean and mellow, and in fine order for a wheat crop at Michaelmas."

Marshall, whose account of farming in Yorkshire was published in 1788, wrote: "The varieties of potatoes are transitory in every district; having their entrances and their exits." It is evident that potato disease was a serious trouble in Marshall's day, as he remarked: "There is some reason to believe that the disease, which has of late years been fatal to the potato crop in this and other districts, under the name of 'curled tops,' has arisen from too long a continuance of declining varieties. Be this as it may, it appears to be an opinion established here by some years' experience, that fresh varieties, raised from seed, are not liable to that disease." The prevailing method of raising potatoes from seed Marshall found to be as follows: In autumn, when the potato apples were beginning to fall spontaneously, they were gathered by hand and were preserved in sand until the spring; the seeds, after being separated from the sand, were sown in fine garden mould, and when the plants were in rough leaf they were transplanted in rows in a bed of fresh, rich mould. The first year the tubers varied in size "from the hazel nut to the crab"; in the second year they were of middle size; by the third or fourth year full-sized potatoes were produced. From the large number of varieties obtained in this way a careful selection was made of those kinds that in one plant possessed the essential properties of good quality and productiveness. These, when established, were widely distributed throughout the country. Marshall advised farmers to raise potatoes from seed because he had observed that varieties of potatoes, like those of corn, "are partial to particular soils and situations," and by this means they obtain, "with a degree of moral certainty, a sort adapted to their own particular soils and situations."

In August, 1867, I met with an Irish labourer in Skipton, who, in the course of a chat, made the following statement: "It is just twenty-one years to-night since the Almighty killed our potato crop. I packed up at once and left old Ireland, and came here." Mr. W. Steuart Trench, who resided at Cardtown, in Queen's County, has vividly described the terrible calamity alluded to by the Skipton labourer, in his book entitled, "Realities of Irish Life." Encouraged by his success in reclaiming rough mountain pastures covered with heather by cultivating potatoes, he planted, in the spring of 1846, about 162 statute acres with this vegetable. "In July," he writes, "my potato crop, for its extent and luxuriance, was the wonder of everyone who saw it; and at the very moderate price of threepence

per stone (£2 5s. per ton), a price potatoes could always then command, I felt certain, humanly speaking, of realising by their sale at least £3,000" (over eight tons per statute acre). On the 1st of August, Mr. Trench, hearing "a sudden and strange rumour that all the potato fields in the district were blighted," immediately rode up to see how his own crop fared. He found it "as luxuriant as ever, in full blossom, the stalks matted across each other with richness, and promising a splendid produce." On the 6th of August he rode up as usual to see the crop. On his way he recognised "the death sign" and knew that his splendid prospects were not to be fulfilled. "All was gone, and the crop was utterly worthless." But the sudden loss of capital and financial ruin that the loss of the potato crop in Ireland brought about, disastrous as it was, is insignificant when compared with the appalling loss of life and the terrible suffering that the potato rot caused. Gold and silver flowed into Ireland. There was an abundant supply of corn and meal within a few miles of the stricken districts, but for lack of energetic men "to bring the food and the people together" the people died with silver in their hands—they had not the strength to get to the storehouses. "They died in their mountain glens, they died along the sea-coast, they died on the roads, and they died in the fields." . . . . This calamity made it impossible for the repeal of the Corn Laws to be any longer delayed, and Sir Robert Peel's Bill passed. The people left Ireland in thousands for America, where they built up homes more worthy of the name than the hovels that contented them in their native land.

Soon after this crisis in the history of the potato, William Paterson, of Dundee, came to the front. Everywhere in the United Kingdom the crops were diseased. The salvation of this valuable vegetable apparently depended on the discovery of a disease-resisting potato. Paterson possessed "an infinite capacity for taking pains"—Carlyle's definition of genius. Regardless of trouble and expense, he persevered till his labours were crowned with success by discovering varieties of potatoes that restored the potato-growing industry to prosperity. Although his efforts were attended by pecuniary loss to himself, the fact that his achievement largely benefited his country was the highest form that reward could take. In the course of an interesting paper on "The development of new breeds of potatoes," Mr. Archibald Findlay, of Mairsland, Auchtermuchty, in alluding to William Paterson's work, said: "His potato, the Victoria, was about the biggest gift ever bestowed on the human race. I refer to its influence on the potatoes of to-day. Individually, for breeding purposes, I would not give a farthing for any potato if I could not trace its descent from the Victoria either on the male or female side." Paterson finally came to the conclusion that the potato plant "was only designed to serve its generation, and that, without a constant and successive renewal from the plum or apple of the potato, it was quite possible that this most valuable esculent might be lost altogether." He said, in reference to the difficulties he had encountered in the work he was engaged in: "In regard to many of the varieties cultivated by me, and which were found to be magnificent croppers, and of surpassing quality, my hopes were frustrated. After years of time, and after great expenditure, outlay, and trouble, they had to be disbanded on account of weakness of constitution, being unable to withstand the ravages of disease."

Mr. Findlay produced the Bruce by cross-fertilisation. The Victoria and the Rose were the kinds that he made use of. "Up-to-Date" is a

variety that Mr. Findlay brought out in 1893—a potato that, in his opinion, "brought more sunshine into the homes of the agricultural community than anything else in connection with farming." This remark he made to Mr. W. C. Sambrook, the editor of *The Agricultural World.* The Up-to-Date potato has certainly proved to be a great boon to farmers in all parts of the Kingdom. Amongst other valuable varieties introduced by Mr. Findlay are British Queen, Farmer's Glory, Klondyke, Evergood, Royal Kidney, and Northern Star. The value of the Eldorado, Gold Reef, Diamond Reef, and Million Maker has still to be proved by growers for the market. Mr. Findlay considers that, whilst eighteen years is usually the serviceable life of a potato, its good commercial life is practically confined to twelve years.

The famous Champion potato, now past its day, was raised by Mr. John Nicol, of Auchterlonie. The Duchess of Cornwall potato, which is probably one of the best of the varieties recently introduced, was raised by the late Mr. William Kerr, of Dargavel, Dumfries. Many valuable varieties have from time to time been introduced by Messrs. Sutton and Sons, of Reading—notably the Magnum Bonum, which was long considered to be the best potato to be found in this country. The celebrated Dalmeny potatoes were raised by Mr. John Hunter. Mr. John Niven, of Madderty, Crieff, the raiser of the Langworthy variety, has recently raised two new varieties, viz., Peacemaker and Table Talk. The Factor and the Crofter, raised by Mr. T. S. Chapman, of Bathgate, are varieties that are making rapid headway in public estimation.

In order to secure an abundant crop of potatoes of good quality, it is necessary not only to plant good seed, but also to supply manures that are suitable for potatoes. Lime and potash are indispensable. The experiments conducted by the Irish Department of Agriculture may be studied with advantage.—*The Agricultural Gazette.*

MILK FOR CHEESE-MAKING.

Influence of Quality.

The following is an extract from a lecture by Mr. D. K. Robb, in which he explained the results of experiments he had conducted to show the value of butter-fat on the yield of cheese. There seems, he said, to be a pretty general belief that all milks are equal in value for cheese-making. This belief seems to be based on three assumptions :—

(1.) That fat has no influence on the yield of cheese.

(2.) That all milks contain practically the same amount of casein ; and

(3.) That when milk contains more than $3\frac{1}{2}$ or 4 per cent. of fat it is impossible to retain it in the process of cheese-making.

What are the actual facts ? In regard to the second assumption, that the amount of casein is practically constant in all kinds of milk, it is not

borne out by my experiments nor the work of others. As a general rule when the fat of milk increases the casein also increases, though perhaps not quite in the same proportion. Above 4½ per cent. of fat the casein appears to increase less rapidly than in milk containing less than 4½ per cent. fat. Therefore, as fat and casein are the two solid constituents chiefly concerned in cheese-making, it follows that milk rich in fat must produce more cheese per 100lbs. of milk; and more cheese to the dairy farmer means more money. The following table gives the quantity of milk used in the experiments, the percentage of fat in the milk, and the average yield of green cheese:—

Quantity of Milk used in Experiments (lbs.)	Number of Gallons.	Percentage of Fat in Milk.	Yield of Green Cheese in lbs.
102½	10	2·0	6·02
102½	10	2·5	7·25
102½	10	3·0	8·45
102½	10	3·5	9·63
102½	10	4·0	10·45
102½	10	4·5	11·32
102½	10	5·0	12·39

In looking at the table, it will be observed that the same number of gallons of normal milk was used in each instance. In the last column it will also be noted that the yield of cheese rose with the increase in the percentage of fat. With ten gallons of milk showing 2 per cent. of fat there was a yield of 6·02lbs. of cheese, while the same quantity of milk containing 5 per cent. of fat yielded 12·39lbs. of cheese, or an increase of 6·37lbs. This clearly showed that the yield of cheese per 100lbs. of milk increased when the percentage of fat increased. These results are in perfect harmony with the experience of every practical dairyman, for is it not the case that in the spring of the year, when cows are newly calved, one gallon of milk will not, under ordinary circumstances, produce 1lb. of curd in Cheddar cheese-making, but as the season advances and the milk consequently becomes richer the yield of curd is proportionately increased?

Ratio of Milk to Cheese.

With poor milk, it takes a much larger quantity to produce a pound of curd, and this is well shown in the following table:—

Percentage of Fat in Milk.	Weight of Milk required to make 1lb. of Cheese.
2·0	17·10lb.
2·5	14·20lb.
3·0	12·07lb.
3·5	10·70lb.
4·0	9·85lb.
4·5	9·09lb.
5·0	8·31lb.

From these figures it is very evident that the value of normal milk for cheese-making is dependent on the amount of fat it contains; and this should most certainly form the basis for the sale and purchase of milk, not only for cheese-making, but for all purposes. It is a method adopted in other countries, and in some parts of our own, and were it fully carried into effect in this country we would hear a great deal less of milk prosecutions.

Looking at the price of milk from this rational point of view, it will be interesting to compare the return for the different qualities of milk, as shown by these experiments.

The following table supplies the information :—

Quantity of Milk.	Percentage of Fat.	Yield of Green Cheese (lbs.)	Value of Green Cheese at 6d. per lb.	Return of Milk per gal. based on yield of Cheese.
10 gallons ...	2·0 ...	6·02 ...	3/- ...	3½d.
10 ,, ...	2·5 ...	7·25 ...	3/7½ ...	4¼d.
10 ,, ...	3·0 ...	8·45 ...	4/2½ ...	5d.
10 ,, ...	3·5 ...	9·63 ...	4/9 ...	5¾d.
10 ,, ...	4·0 ...	10·45 ...	5/2½ ...	6¼d.
10 ,, ...	4·5 ...	11·32 ...	5/8 ...	6¾d.
10 ,, ...	5·0 ...	12·39 ...	6/2½ ...	7½d.

Calculated on the above basis, we see that the value of normal milk for cheese production rises approximately ¾d. per gallon for every rise of a-half of 1 per cent. of fat the milk contains. Thus, milk containing 3 per cent. of fat is worth 5d. per gallon, while 3·5 per cent. is worth 5¾d. per gallon, and 4 per cent. is as cheap at 6¼d. per gallon. These figures show the comparative values of milk for cheese-making, and they also show the injustice of a fixed price for milk per gallon, irrespective of quality.

Quality and Quantity.

Dairymen in the past have been inclined to put too much stress on the yield of milk, irrespective of quality. We see from the above figures that quantity is not everything. Whenever watery foods are fed in excess, and to the exclusion of a sufficient quantity of nutritious matter to balance the ration, it has undoubtedly a tendency to produce more milk, but of poorer quality. It therefore follows that unless the cows have been bred on right lines, and getting a fairly-balanced ration, the increase of cheese will not be in proportion to the increase of milk, and the strain on the cow is much more severe.

Supposing we have in a herd three cows, the first yielding, say, 460 gallons of 4 per cent. milk, the second giving 500 gallons of 3·5 per cent. milk, and the third producing 570 gallons of 3 per cent. milk, which would be the most profitable cow for a cheese-making dairy? The number of gallons or the percentage of fat quoted are nothing out of the common, and yet to the dairyman who seldom knows anything of the fat contents of his different cows' milk, he would, without the slightest hesitation, take the cow yielding 570 gallons as being the most profitable cow for him, while, as a matter of fact, so far as cheese production is concerned, the three cows are equal in value.

Improved Quality.

It is well known that cheeses made from skim milk are tough, hard, and leathery. They are unpalatable and much more indigestible than cheese made from rich milk. They may have plenty of corky body, but they have in all respects lost their soul. So it is with milk containing varying amounts of fat; the richest, other conditions being equal, will always give us the nicest, creamiest cheese, with good body and flavour, which is so desirable in a table cheese, and which regulates the price to a very great extent. Then we must also consider the shrinkage during the period of ripening of the different qualities of cheese. In the process of ripening at ordinary temperatures, the loss is very much greater during the early stages of ripening, and during the first month it may amount to as much as two-thirds of the total loss, depending, of course, on the temperature and relative humidity of the curing room. With cheese made from poor milk the loss in curing is much greater at all stages than with cheese made from rich milk.

The cheese made from poor milk contains, as a rule, a higher percentage of water when new, but on account of their more open texture they part with their moisture much more rapidly.

The loss of Fat.

Coming now to the loss of fat in cheese-making, there seems to be a very general opinion amongst cheese-makers that the more fat the milk contains the greater the loss in the process of manufacture. How or where this idea has originated is difficult to understand; but I have been told on several occasions by different makers that to prevent this supposed loss when the milk becomes rich, and especially in warm weather, they abstract a part of the cream. It is seldom in Scotland that we have milk showing on an average more than 4 per cent. of fat, and with milk of this quality, or even richer, with proper skill and care in manipulation, there should be no abnormal loss of fat in cheese-making. The results of my experiments, and many others in many parts of the world, confirm this opinion. The following table shows the loss of fat with different qualities of milk:—

Percentage of Fat in Milk.	Percentage of Fat in Whey.
2·0	0·27
2·5	0·29
3·0	0·30
3·5	0·32
4·0	0·29
4·5	0·28
5·0	0·32

These figures show that the loss of fat in Cheddar cheese-making is quite independent of the amount of fat in the milk. What constituents are lost in cheese-making? In the ordinary process of cheese-making, and under normal conditions, most of the water, albumen, and sugar passes off in the whey with some of the mineral constituents, and a small percentage of fat and casein. The casein and fat, with small quantities of albumen and sugar, form the cheese-producing solids. Is it necessary to lose any fat in cheese-making, and what conditions produce

Unnecessary Losses?

The fat of milk exists in the form of small drops or globules, distributed through the milk in very large numbers, and when milk is "thickened" or coagulated by rennet, these globules become imprisoned in the solidified mass. In the process of cutting the curd many of these globules are liberated, and pass into the whey, and are not retained in the curd, hence our small loss. This, then, is the cause of a small loss under ordinary circumstances, but there are many other conditions which contribute to loss of fat. For example, in abnormal milk, when the percentage of casein is low compared with the amount of fat, or when coagulation does not take place properly, there is an extra loss of fat. Anything that prevents complete coagulation, such as the addition of preservatives, like borax, boracic acid, formalin, or the addition of a fairly large quantity of water, is likely to cause loss of fat. Shaking or stirring the milk during coagulation; cutting the curd when it is too soft, or cutting it too fine; careless manipulation of the knives in cutting the curd; stirring too soon with the rake; heating curd too rapidly, especially in the early stages; putting curd to press too warm, and applying too great a pressure at first are all likely to cause increased loss of fat. Besides these, an excess of acid in the milk, and forms of fermentation that dissolve casein, also increase the loss.

TESTING CEYLON-GROWN COTTON.

Important results.

We are very glad to be able to announce that the first Tinnevelly cotton taken from the Government plantation at Maha-illuppalama has been tested with the most satisfactory results. Three bags had been sent down from the plantation, and at the Ceylon Spinning and Weaving Mills the cotton went through the first cleansing process in the presence of Dr. Willis, director of the Peradeniya Gardens, and Mr. Whitehead, the cotton expert of the mills. The results were exceedingly satisfactory, the rolls of cotton coming out a great deal whiter than the Indian-grown kind, which is most largely used here. The cotton in three bags, as received, weighed 100lb. in all, and after the process, the same cotton, with dirt and seed removed, scaled at 92lb., or with only *8 per cent. loss*. Mr. Whitehead, who has been working at cotton all his life, and can tell from the look of it whether cotton has been well ginned or not, was of opinion that, with superior ginning, the loss would be only 6 per cent. As Tinnevelly cotton is eagerly bought with a loss, he says, of as much as even *15 per cent.*, it is obvious that the Ceylon-grown article turned out is of a splendid quality. With suitable soil, such as is on the experimental plantation near Anuradhapura, the prospects of this class of cotton in Ceylon should be very bright. On the other hand, the cost of ginning has to be considered. Roughly, Mr. Whitehead valued the cotton turned out at "3d. and 2 to 3 32nds of a penny" per lb. But Dr. Willis reckons the cost of the ginning by hand, which has been followed hitherto on the field, at about 17 cents per lb., for the coolies in the Anuradhapura district would not work above five hours a day and want 50 cents per day. This cost is a high figure, however, and will be very much reduced when the $2\frac{1}{2}$ horse-power engine and proper ginning machinery are installed at Maha-illuppalama. Meanwhile, the results obtained are eminently satisfactory. The cotton above referred to had an excellent appearance as it passed later through the combing machine, flowing into the soft strands which compared most favourably in colour with the Indian, and also—when a torn piece was held side by side with one from the Indian cotton—in length of staple.

Apart from the tests made, it is highly satisfactory to know that in the Ceylon Spinning and Weaving Mills there is room for all the cotton that Ceylon is likely to be growing for some years to come to be absorbed; and, for awhile at least, it must, indeed, form only a moderate portion of the total quantity there handled. In a cotton factory there is very little waste, and even the "side-shows" as it were, where the unclean portion of the raw cotton when first removed are dealt with, are well worth a visit. Sometimes the cotton is boiled to remove all fat and oily substances; fat is not usually associated with cotton, and is not found, of course, in quantity with it. Most oil occurs when the cotton is badly ginned, and when, in cleaning, the seed becomes compressed and oily substances impregnate the surrounding cotton. Meanwhile we advise all "pioneer" planters of cotton ("pioneers," that is, in a new agricultural era) to send their cotton to the Ceylon Spinning and Weaving Mills, and to send the reports upon it to the Press for publication—*pour encourager les autres.*

BEE NOTES FOR THE MONTH OF AUGUST.

By John Sutton, Bee Expert.

While complying with the request of several persons interested to publish notes a month in advance, I feel constrained to say that no invariable rules can be laid down for the work to be done in an apiary for each month which can be strictly followed in every place, not even in the same district in every year. The whole plan of operations must be suited in the first place to the normal climate of the district in which the apiary is situated, the nature of the bee forage available both in the spring and the honey season, and to the natural habits of the bees as influenced by their local peculiarities. Taking these circumstances into account, a set of rules may be established suitable to the average seasons, but even these must be liable to some modifications at the judgment of the apiarist, according to the variations of different seasons.

Much depends upon the manner in which the bees get through the winter months, upon their condition in early spring, and upon the time which they commence to rear brood extensively and to prepare for swarming.

When we have had a mild winter, followed with an early spring, it is common to have swarming in the Perth district early in August.

So soon as the weather becomes settled, and fine sunny days prevail, the first opportunity all hives should be overhauled and the condition noted. See to the food supply, and feed where short of stores, as a much larger quantity will soon be required for feeding brood, and if the weather continues fine, all bottom boards should be cleaned, and division boards should be put in where required. Where brood rearing has commenced, every care should be taken to keep the brood nest *snug* and *warm*. Any faulty or mouldy combs should be removed and fresh ones put in their place; close attention should then be given to weak colonies. Queenless stocks may be united to some weak one that has a queen. Stimulate any colony that may be required for rearing early queens.

While overhauling, make a record for every hive showing date of inspection, number of frames containing brood (where queens are clipped). See that your old queen is present, and is clipped, as should she be superceded, it may cause you trouble later, when swarming begins.

Spare hives and frames should be got ready, and every appliance needed should be seen to and repaired where necessary.

Every live apiarist whether looking forward to increase in his number of stocks, or the honey harvest, will have everything in readiness in advance. Once behind in the swarming season, it takes some time to pull up and get back to normal condition, and often means disorganisation and loss.

DISEASES IN HONEY BEES.

By John Sutton, Bee Expert.

(*Continued.*)

Dysentery.

When bees are suffering from dysentery, the disease generally is noticeable at the end of the winter months, or early in the spring.

Symptoms.—When examining a colony affected with this trouble, it will be found that the bees have discharged their excrements over the combs, on the bottom| board and the alighting board, as they never do when in a healthy condition, being, as a rule, particularly clean in all their habits. The matter discharged has a very offensive smell, and varies very much in colour, from an orange to a dark or reddish brown, according to the nature of the food that has been used, and is responsible for their condition.

Cause.—When bees have been confined to their hives, and not able to take a cleansing flight, and when they have consumed an excessive quantity of food, which has become sour, resulting from unsealed honey, which has fermented during damp weather, or in some cases dampness in the hive has set up fermentation in old pollen, they become subject to dysentery, and being then unable to retain the excrements, they void them anywhere.

Prevention.—To guard against this complaint, be careful to see that before winter they have sufficient sealed stores within their reach to keep them over the winter months. Should there be any need to feed to make up the required quantity of stores for wintering, pure cane sugar, mixed into a syrup, is preferable to diluted honey.

Treatment.—When an attack of dysentery has set in, the bees, on the first opportunity, should be transferred to a clean hive, and contracted to just as many frames as there are bees to cover the soiled combs removed, and washed clean, and clean combs should be given; feeding them with candy or sealed honey, and the bees kept warm, and not disturbed more than is necessary.

Paralysis.

This malady is sometimes very bad, but one peculiar thing regarding it is that it comes and as suddenly disappears; at other times it will in a very short time reduce a fairly strong colony till it becomes very weak indeed, then as suddenly disappearing. The cause of paralysis is practically unknown.

Symptoms.—In its earliest stages, the affected bees may be seen to be leaving the hive in large numbers, with their abdomen greatly swollen. Later the shaken and trembling due to paralysis is very noticeable, and healthy bees may be seen dragging the unhealthy ones from the hive, and in a very little time the colony will become weak, and if the disease continues it soon dies out altogether.

TREATMENT.—One of the first things to do is to re-queen, but this is only effectual in the early stage. Transferring the colony and placing in its place a strong and healthy colony, and dusting with sulphur, is another remedy that has been reported as most favourable when it is done thoroughly. First remove all combs containing eggs and open brood, giving them to some other colony, then in the evening, after all the bees are in the hive, dust every bee and every comb with sulphur; next day the combs that were taken to be returned to the hive. The reason for removal of these combs while sulphuring, the dusting with sulphur would kill the larvæ. No alteration will be noticeable for a week, sometimes longer, after treatment

CHILLED BROOD.

"Chilled Brood" is ofttimes a pest, and the name is given to a condition of larvæ which have died through being left uncovered, when the larva dies. It is mostly found after a sudden change in the spring, and mostly in the apiaries of careless people, or those lacking knowledge as to the requirements of the bees.

SYMPTOMS.—Chilled brood is sometimes mistaken for foul brood, but on close examination of the brood found dead in the cells, it will be found at first grey, and later quite black—in no case brown, the colour of foul brood.

CAUSE.—This may be caused in spring, when the brood nest has been unduly extended, after which a sudden return of cold weather which forces the bees to cluster in the centre of the brood nest, leaving the outside frames of brood uncovered. Excessive swarming is in some cases responsible for brood fully matured in the cells being left without enough bees to keep them warm; sometimes from the hive not being secure from wet and cold. Spreading brood may often be the cause, when done by any one that has not had much experience.

PREVENTION.—Avoid exposing the brood to chilly winds; never remove combs during cold days. In the early spring keep hives warm and dry; never spread the brood until settled weather with warm nights prevail, for a sudden drop in the temperature at night is fatal to young brood only partly covered. Keep strong colonies, and the bees when weak tucked up warm, on no more frames than there are bees to cover.

TREATMENT.—When opportunity offers, and any large patches are found to be dead, and the stock is weak, break the cappings, and if practicable join it with another colony (after breaking open the cells), when the bees will carry out the dead. If this is done in the early stage, little further trouble will be found; while, if left to a later stage, it would be better to cut out the dead brood, which should be burned or buried.

BLACK BROOD.

This disease (bacillus milli-bacillus thoracis) is reported as more dangerous than foul brood in some parts of America, and quite as destructive, as it affects the adult bees as well as the brood.

SYMPTOMS.—A description given by the New York Bee-Inspector is as follows, and may be valuable:—

> "The young larvæ have a yellowish speck upon the body, about the size of a pin head; while the older brood stand out lengthwise in the cell, sharp at the ends, white, but not capped over. This

brood dies, and is either removed by the bees, or later flattens down in the cell and becomes a cream colour, and in a later stage, a coffee-coloured mass. Later in the season some brood that died in the cells which had been capped over, becomes a rotten mass—a coffee-coloured matter, about the consistency of heavy honey. A tooth pick dipped into this if drawn out causes this matter to stretch from half an inch to an inch, but does not break and fly back as quickly as in 'foul brood.' The smell is not very bad, but in some cases it has a sour smell; while in some of the sealed, rotten, coffee-coloured brood, there is a kind of rotten smell, but not like that of the old-time 'foul brood.' Howard states, with regard to this disease, that the brood is usually attacked late in the larva life, and dies during pupation, or later when nearly mature and ready to come forth through the chrysalis capping. Even after leaving the cell the bees are so feeble that they fall from the combs helpless. Most of the brood die after sealing. When the larvæ show the first signs of the disease there appears a brownish spot upon the body about the size of a pin head. The larvæ may yet receive nourishment for a day or two, but as the fermentation increases the brownish spot enlarges. The larva dies, and stands out swollen and sharp at both ends. In time the brood becomes rotten, and these rotten masses in time break down and settle to the lower side of the cells as a watery, syrupy, granular liquid, not like the sticky-ropy or glue-like semi-fluid substance of 'foul brood.' It does not adhere to the cell-walls like that of 'foul brood,' and has not the characteristic foul odor which attracts carrion flies, but a sour, rotten-apple smell. The cap is disturbed from without, sometimes uncapped and the cell-contents removed by the bees."

Howard, in connection with this disease, described an organism which he considered to be the casual agent of "black brood." He gave the name of Bacillus milli to it, from its resemblance to millet seed. The B. milli is a spindle-shaped organism which forms spores, and, according to Howard's drawings, forms two spores in each cell, a rather remarkable occurrence, for in bacteria, as a rule, only one spore is found in a single cell. No description is given of the germination of these spores, nor the cultural features of this organism; so that, except from its peculiar shape and its ability to form two spores, it would be a rather difficult matter to identify this organism.

Howard claims to have produced the disease by feeding bees with syrups containing B. milli.

From the evidence of those familiar with this disease, there is considerable doubt whether black brood is really a new disease, or whether it is really a disease closely allied, if not identical, with foul brood, but occasionally showing appearances which are different from the general appearance of foul brood.

Remedies.—The best time to effect a cure is during a honey-flow; adopt a modified McEvoy plan. Make your stocks strong by uniting; place them upon comb foundation starters, and cage the queen. After five days remove the starters and make them into wax, and give full sheets of foundation—keeping the queen caged for five days longer. This will give time for all infected mature bees to have disappeared before any brood is reared.

Don't try to save infected mature bees by drugs. They are not worth the trouble. If a cure is contemplated when little honey is coming in, this modified McEvoy plan should be observed in every detail, and the bees fed with medicated syrup (sodium salicylate, one ounce; water, five gallons; white sugar, forty pounds; kake syrup without heat) until the combs are well filled, so that all food may be rendered antiseptic by the time of brood-rearing begins.

Great care should be taken to melt all old combs and removed starters into wax at once; do not use a soler wax extractor, but remove the material at once to hot water, or steep extractor. Until further investigations shall reveal the longevity of these germs in open air, I shall recommend a thorough disinfection of the hives, frames, etc., by boiling in linseed oil for half an hour. This would not injure the hives or fixtures; besides, the high temperature reached would insure thorough disinfection. Careful, practical, and experimental work, coupled with microscopical investigations in the presence of the disease when at its worst, will, I feel confident, discover some practical plan for its successful eradication.—Recommended by Dr Howard, after his investigations of the New York black brood.

Starved Brood.

There are instances when starving of brood is very noticeable, notably after an abundant honey-flow, when in cases where a prolific queen has induced the bees to encourage a very large brood deposit, and in the excitement of the moment a severe extracting of honey has taken place, after which there comes a sudden check in the gathering of food through bad weather, bush fires, and from any other reason. The brood in these cases do not die suddenly, but show the effects of the shortage of food; they become emaciated and dry up, rather than putrify, and on close examination. the larvæ in all stages shrivel up in the cells.

General Treatment and Remedies.—"Remove the cause and the effect ceases." Practically all methods of cure of infectious diseases of bees adopt the above maxim more or less, for the various starvation methods aim at getting rid of the infected honey and the infected combs. Treatment by means of medicated syrups has been tried again and again, and which has apparently checked the advances of the disease for a time, only to break out again more severe, in most cases. There can be no doubt, in the hands of those thoroughly conversant with the many diseases and the influence of medicated food on the several diseases, good results may be accomplished; but the average bee-keepers are not scientists, and as so much depends on mixing the several required ingredients in the correct quantities, and also the trouble to get the bees to take kindly to these medicated foods, must be given as my reason for omitting those in this treatise.

Howard, in his treatise on foul brood, says:—

> "From my own observations I must conclude that spraying the combs will not reach the germs in the honey or the spores in the glue-like dried masses entirely submerged with the honey in the cells, sealed or open, nor will feeding medicated syrups to old bees in a 'foul-broody' colony cleanse the 'feet and antennæ,' or purify the combs containing the foul masses, or the foul cells in which the eggs are deposited by the queen, even though it might eradicat the disease (?) from the old bees, which has not the power of reinfection."

Mr. W. McEvoy, who has a larger practical experience than any person in the present age, is just as emphatic on the use of drugs for the cure of foul brood, even going so far as to dispense with disinfectants for the hive. He claims, and has given practical proof, that he can make a thorough cure, without removing the bees from their own hive, without the use of any drug—simply starving the bees for a limited term as stated above.

HOW OLD ARE WORKER BEES WHEN THEY FIRST GO OUT IN SEARCH OF FOOD?

Can Young Bees do all the Work of Feeding Larvæ?

By F. Greiner.

It has been repeatedly proven that worker bees become field workers, under normal conditions, when about 18 days old. But when man interferes and disarranges matters in the hive, bees may and do go out when five days old. No feeding need be done to start them, either. You may remember one of my experiments, made a number of years ago, when I made up a small colony from brood-combs full of matured and nearly matured bees, with not one hatched bee in the hive—this, of course, during the honey flow. From this colony bees came out of their hive on the fifth day, in the afternoon. They had a flight, a play-spell, and then went to work at once bringing in pollen and honey like any other colony. They continued to do so. One of the combs contained just a little young unsealed brood and a few eggs, perhaps not more than fifty cells in all. These were given on purpose. The fact that this brood was not neglected, at least did not perish, I take as conclusive proof that young bees just hatched are not such very helpless "critters" after all. When such larvæ are neglected for but a short time they show the effect very quickly, as every beeman well knows. I have not observed closely enough to know for how long time a larva might stand such neglect. It might be well for us to look into this matter before we advise the making up of new colonies from the brood-combs of shaken hives without some bees. It will seem to me it would be placing an herculean task upon the shoulders of the young bees as they are hatching, when we expect them to administer to the wants of that large number of hungry larvæ contained in an average set of brood-combs. They can not possibly be equal to the emergency, although I have not made the experiment. I never had the courage to make it, and never expect to. It is too risky.

The combs of brood which I used for my experiment contained brood which was more than three days of hatching—some were emerging at the time. To obtain this brood, several queens had been taxed. Nice clean

GWAMBYGINE

combs had been inserted in different hives at one and the same time, had been kept there for three days, when they were removed and placed in an upper story on some good populous colony with queen-excluding sheet of metal beneath. There was no question as to the age of the brood, and it all hatched. Ordinary brood-combs, picked up at random, even if all brood was sealed, would contain a good deal of it only just sealed, and a day or so after being sealed. I fear such brood would suffer if not covered with bees enough to maintain the temperature. It would be out of the question to depend upon artificial means to keep the combs warm. We seldom have such weather as would be necessary to prevent brood cooling off to a point of danger; and, therefore, I deem it a ruinous practice to leave unprotected brood to its fate in the way mentioned. There are better and safer ways to make increase.—*Gleanings in Bee Culture.*

Naples, N.Y., 24th January, 1905.

THE FLOW OF NECTAR.

How it is Dependent on Atmospheric Conditions; the Effect of Thunder-storms; some interesting Observations.

By E. J. Crane.

The effect of the weather upon the flow of nectar in flowers is not, perhaps, a very practical question, and yet it is one in which I have been greatly interested for the past 35 or 40 years. It is not probable that Franklin had any thought of telegraphs or telephones, electric lights, or trolly cars, as he studied the phenomena of electricity. It is not at all certain that, if we knew just the effects of the weather upon flowers, we could in any way alter those effects; yet it may be well for us to understand them. Beyond the suggestion that the season was either too wet or dry, or too cold, we seem to know little upon this subject.

If we place a populous colony, with an abundance of room, upon a pair of scales we cannot help being interested during the honey season at the almost constantly varying yield of honey from day to day. Sometimes we may be able to tell with some degree of certainty the cause, but more frequently we may not. I remember very distinctly my experience some twenty-five or thirty years ago when I kept a careful record of the weather, using a wet and dry bulb thermometer. Two days stand out very clear in my memory. It was during white-clover bloom. There had been for some days a very good flow of nectar—6, 8, 9, 12, and one day it ran up to 15 pound gain, the greatest of the season. It was one of those soft balmy days, the temperature just right for comfort, the wind south, the sky a little hazy, the outlines of the distant mountains indistinct. The conditions

seemed nearly perfect for the flow of honey or nectar. During the night that followed there was a change. The next day the wind was north; the sky clear and blue; the air more bracing than the previous day, although not cold; the outlines of the mountains east and west were sharp and clear; the bees could fly from morning till night. Surely the bees ought to gather a large amount on such a beautiful day. Imagine my surprise to find that night they had gathered only three pounds. What made the difference? There were just as many flowers, the same bees. The instincts of the bees had not changed, nor was there anything to prevent the bees gathering nectar, but the lack of it, so far as I could see.

A very wet season is generally considered very unfavourable for a good yield of honey; and yet the two wettest seasons I have known in the past fifty years both gave most excellent crops of honey, much above the average.

I have found it a rule that honey is more plentiful when the wind is south than when in the north. I live between two mountain ranges, and we have very little west wind. In a season when there is a large flow of nectar we may get better results with north wind than with the south wind in seasons of scarcity. I was told, when I began keeping bees, that showery weather is favourable to honey gathering; and if we watch the bees come in just before a shower we may come to that conclusion ourselves. But if we stop to think we may remember that as many bees as would ordinarily come in in one or two hours rush to their hives in perhaps ten minutes or less. One hive on scales on such a day will show no increase over others; and if the shower is a thunder shower, the following day is quite sure to show a decrease in the amount gathered.

Not only do thunder-storms appear to be deleterious to the flow of nectar, but often almost fatal to securing a good crop of honey. My attention was called to this some years ago during clover bloom. The season was rather late; but early in July the fields were white with clover, and bees were storing honey rapidly. One day I went to one of my outyards when I found the bees idle, nothing doing. Indeed, I have sometimes thought that, had a fire passed over the range of this yard of bees, the flow of nectar could hardly have been more quickly or completely cut off. I found, on looking it up, that a severe thunder-storm had passed over the range from which this yard of bees gathered their stores, two or three days previous to my visit. I noticed another thing quite as surprising—that my other yards of bees gathered little honey after this time, although they seemed to work more than the one in the immediate track of the storm. Was it possible that a heavy thunder-shower would not only affect the flow of nectar in its own track, but also some distance from it? It certainly looked that way. My attention was called to this subject a few years later when I noticed a great decrease on one day below the previous day, without any apparent reason for it; but on looking over a daily paper it reported an unusually severe electric storm as passing some 30 miles to the north of where I live, on the first of the days mentioned.

The flow of honey the past season was one of unusual interest from a scientific standpoint. There was a very good flow of clover for about three weeks, when it dried off and basswood bloom came in. As often happens, the basswood gave little nectar at first; but after a few days it began to yield fairly well, at first slowly, soon increasing to nine pounds in one day from hive on scales. "Now," I said to myself, "we shall at last get a

fine crop of basswood honey, which we have not secured for several years;" but, alas for human expectations! The day following a yield of nine pounds, there was a gain of only five pounds, and the next of only two; and then a loss, the colony on scales not even gathering enough to live on, although very strong in numbers and basswood at its best so far as amount of bloom goes, and the weather such that bees could fly most of the time.

What could be the cause of such a complete failure from basswood, for the yield after this was very light, although the bloom lasted for many days?

After former experiences, I accounted for it in this way: On the day of the largest yield there was a severe electric storm a few miles to the north-west from here, doing much damage. This appears to have cut down the yield here nearly a half the next day, when, near night, we had a storm where my yard was located, when on the following day there was another reduction. In fact, this same showery weather continued for several days; although bees could fly most of the time, the flowers refused to yield their nectar.

Thunder-storms do not appear at all times to be equally injurious and at times the flowers will in two or three days resume their normal condition after a storm, while at other times they seem to lose their power or disposition to furnish nectar for the rest of the season.

I should not like to say that thunder-storms are the cause of the decreased flow. It may be that the conditions favourable to the development of storms may be unfavourable to the production of honey, although the decrease of honey occurs after the storm rather than the same day.

Where a thunder-storm occurs with a heavy rainfall, followed by a north wind and a lower temperature, there is almost sure to be a decrease in the honey-flow.

Now, while severe thunder-storms appear to be very detrimental to the flow of nectar, a rain unaccompanied by electric display does not appear to injure the flow of honey unless it comes off cold after it. The wettest season I remember, and a particularly good one for honey, was in 1872; but the rain came almost wholly, not in thunder-storms, but the sky would be covered by a light haze which would be deeper and thicker when the rain would come down, after which it would break away without thunder or lightning, only to be repeated a day or two later. In fact, such weather at times seems to increase the honey-flow. In 1880 we had in this section a peculiar season. We had little or no clover, owing to the previous open winter. Early in May I went to a neighbouring county trying to find a place where I could move my bees so they might secure enough for winter. On my return I found basswood was going to bloom full, and I decided to leave them where they were. Presently basswood came into bloom, and the bees flew freely from their hives—yes, and buzzed about the flowers, but seemed to get little more than enough to keep them from starving, until the very last week of the bloom, when there came a rainy day, and the basswood turned over a new leaf, as we say, and the flowers gave an abundance of nectar; so the bees worked in the rain, bringing in what they had so long been looking for. The next four days were pleasant, and bees were able to fill their hives and store con-

siderable surplus. Here the rain seemed to be a benefit, but it was quite free from any electrical disturbance, and was followed by warm weather.

I have given these notes that others may take up the subject where I leave it, that in time we may be able to understand the subject more perfectly than at present.—*Gleanings in Bee Culture.*

Middlebury, Vt., 14th December.

SECOND-HAND SQUARE OIL-CANS FOR HONEY.

How to Treat them so as they will be fit for use.

Mr. L. B. Bell, in *Gleanings*, contributes an interesting article on the above subject, and as there is much matter contained therein which should prove useful to beekeepers we here reproduce it. Mr. Bell in his opening remarks says:—"As we have stored and sold from four to eight tons of honey per year for the past 16 years in such cans, without a word of complaint, so far as we know, perhaps our experience will be worth something to the fraternity.

"We use all the gasoline-cans we can get hold of, as they are more easily cleaned; but we also use all the kerosene-cans we get as well.

"I have an old scavenger, or a 'raggedy-raggedy man,' who gathers my cans for me in a local mining town. I pay him 5 cents each for his trouble of collecting and holding them until I go for them. I sometimes bring home 120 in a load.

Repairing Cans.

"When we are ready to make a job of soldering we remove the oil-caps on the cans by holding them over a hot blaze in our soldering fire-pot, until the solder starts, which operation is quite rapid with a good fire. Next we patch any vent-holes which we find, and solder on our screw caps. When we find a can with its sides collapsed so that its capacity is small, after soldering it we straighten it by exploding 1 or $1\frac{1}{2}$ drams of rifle powder as near the centre of the can as we can hang it. It straightens them in a hurry. Tie the powder in a small cloth around one end of a blasting-fuse about eight inches long; cut a gash in the fuse near the other end, and put in a few grains of powder to 'spit' the fuse quickly. Insert this cartridge into the opening in the can the proper distance to bring powder near the centre of the can; secure by tying by a string to a ring on top of the can. 'Touch the button' with a match, and the powder does the rest.

"Cans thus treated may not case well for shipment, but are as good for storage for local use as any. A few experiments will teach you the amount of powder to use for different conditions of cans.

Cleaning the Cans.

"The method we have found the most satisfactory in rapidity and thoroughness is to make a solution of strong soapsuds by slicing up not less than two bars of some good laundry soap (without rosin in it is preferred) to a barrel of water. Add to this not over half a can or about $\frac{1}{4}$ lb. of concentrated lye. We then throw a steam-hose into the barrel, and boil until the soap is dissolved. We use a funnel made with the small end a little smaller than the size of the opening in the cans, to allow for expansion of the cool air in the can, and to prevent the hot suds from being blown back in your face while pouring into the cans.

"We have a $\frac{3}{4}$-inch pipe running from the steam-dome of our boiler so we can get dry steam. This pipe has a perpendicular length sufficient to reach to the bottom of a can, with a valve within convenient reach of your hands. Insert this pipe in a can containing the hot suds, until the lower end of it reaches within about $\frac{1}{2}$-inch of the bottom. Suspend the can in this position by a hook fastened into the ring on the can. Open your valve and let in steam enough to boil the suds, and throw it all over the inside of the can. We boil one can and fill another ready to boil, and rinse out the boiled can. We always rinse with two waters—the first time with clean hot water; the last, clean cold water. With this system one active person can clean 100 or more per day.

"After draining these cans they are laid in a hot sunny place on their sides, with the opening nearest the top, to allow the remaining moisture and any odors to escape freely. We clean cans in hot sunny weather, as the sun is the most effective and convenient form of heat we have found for the volatilizing of the oil odors. We have found the use of concentrated lye in too strong a solution to be unwise. Try a strong solution of it on bright tin, and you will observe that it has a very corrosive effect. Cans thus treated are at once attacked by the acid in honey, discolouring and injuring the flavour of the honey. We leave our cans in the sun about a week, if we are not needing them, then go over them in the heat of the day, when they are hot, and we can easily pick out any doubtful ones by the odor, and leave them for a few days longer. When sunning does not remove the odor, another suds treatment may hasten the cleaning.

"Where access to a steam-plant is not possible, the same results can be obtained by the thorough shaking of the hot suds and a longer sunning."—*Gleanings in Bee Culture.*

A SAFE WAY TO WASH OUT KEROSENE CANS.

Years ago A. I. Root advised the use of washing-ammonia for this purpose. It is superior to lye or caustic potash. I can cleanse a five-gallon can with four quarts of hot water. Rinse the can out first, then put two tablespoonfuls of washing-ammonia with a quart of hot water. Do not screw the cap down tight, but shake thoroughly, then screw the cap down tight, turn the top of the can down, and let it stand a few minutes. Then I rinse twice with hot water. Let it stand a day or so to dry.—*Gleanings in Bee Culture.*

NEW FORMS OF PLANT LIFE.

The following paper on Mr. Luther Burbank's labours in creating new forms of plant life is from the pen of Mr. W. S. Harwood, and appears in the *Century Illustrated Magazine*, March, 1905:—

Scarcely a decade ago Luther Burbank was virtually unknown to the world. He was held in derision by his relatives, in pity by his friends, in scorn by his enemies. He was denounced by scientific men as little less than a charlatan, a producer of spectacular effects, a seeker for the uncanny and abnormal, an enemy to all true scientific progress, a misleading, though powerful, prophet of a new order of things that could never come to pass.

Going a litle further back in his history, to the period in which he first attempted to carry out the work of his life, we find him more than once perilously near starvation in a land of plenty, but rising by sheer force of noble ideals above all temporal ills.

To-day Mr. Burbank has become the foremost man in the world in the productiou of new and interesting forms of fruits, trees, flowers, vegetables, grasses, and nuts. Last year more than six thousand men, embracing among them the very pick and flower of the scientific life of two hemispheres, made the pilgrimage to his Santa Rosa home to study the lines of his investigations, to see with their own eyes many things which their scientific minds could not accept as truth without visual demonstration, and to learn some details of the supreme results achieved. During the year 30,000 letters were received, coming from every quarter of the globe, asking for more light upon his work.

His recognition has been tardy. First came the visitors from foreign lands, where his experiments were first appreciated; then seedsmen and scientists of his own country, many of whom came to scoff, but stayed to pray. Later came a certain perfunctory recognition from his townsmen, many of whom had looked upon him as a strange mystic raising millions of flowers and shrubs only to tear them up by the roots and burn them in great bonfires. Now, latest of all, in some measure, comes recognition from the people of his State and his country. The president of one of the great American Universities the other day, in introducing him to an audience of five hundred professors and post-graduate students to whom he was to make an address, referred to him as the man who had produced more new forms of fruits, nuts, trees, flowers, and plant life in general than any other man who had ever lived since the dawn of creation. As this article goes to press, comes a further recognition in the shape of a subvention from the Carnegie Institution to the amount of 100,000 dollars, available in sums of 10,000 dollars each year for ten years.

Notwithstanding the marvellous creations which Mr. Burbank has already accomplished, a summary of which will follow, he has new work under way, and nearing completion, more wonderful than anything he has yet achieved, and more fruitful of good for the race, while the work he has projected and begun, but which may not even be referred to, has even greater possibilities.

There are millions of acres of arid land upon the globe, much of it, even with the most persistent irrigation, yielding but scantily, and enormous reaches of it devoid of all growth but the cactus, a foe to man and beast; but Mr. Burbank resolved that he would reclaim it, not by irrigation, though welcoming its aid, but by means of the desert itself—the desert and its cactus, its heat, and its sun. So for a period of over ten years he has worked with the utmost persistence and skill until at last he has developed a cactus plant which will convert the desert into a garden. He has made the cactus thornless, taking from its leaves the hard, woody substance, the spicules, so dangerous to animal life. More than this he has made it adaptable to any climate. It will thrive on the hot desert, but it will grow with marvellous fecundity when irrigated or when planted in a richer soil.

But this is not all of the marvel, He has bred this dreaded scourge of the desert, this pariah among plants, until it has become the producer of a delightful nutritious food for man and beast—until, in his estimate, considering the unused areas of the world where it will thrive, it will afford food for twice the people now upon the earth. Millions of beasts for food and for the burden-bearing of man may be supported from the food this plant can now be relied upon to give.

I do not know that I can better illustrate in concrete form the wonderful work Mr. Burbank has done in the reclamation of the desert than to cite, on his proving grounds at Santa Rosa, the example of a cactus of the average desert type protecting its fruit by means of the most deadly thorns, its leaves filled with fibrous substances that bring death to the cattle feeding upon it, while beyond it stands a perfected cactus, not a thorn upon its great green thalli, not a spicule within its rich meat—a huge storehouse of hundreds of pounds of food.

And yet this can tell nothing of the edible qualities of the huge leaves, nor of the delicious flavour of the fruit—fruit which has been bred into a degree of perfection which the wild cactus of the plains never attains.

A quaint smile comes over the thoughtful face of this grave man as he plucks one of the few priceless fruits, the seeds of which are worth far more than their weight in gold, and are the net results of long years of the most patient study and persistent toil.

"If you swallow one seed," he says to my companion, as he cuts the luscious fruit with his pocket-knife, peels away the covering, and discloses the crimson meat, "I may possibly forgive you; if you swallow two I must choke them out of you; if three, then, alas! it must be death."

So we eat the fruit, and religiously preserve the seed. The flavour is something quite unknown to the tongue before—a combination of the flavours of half-a-dozen fruits, suggesting to some a pineapple, to some a melon, to some a peach, to some an apricot, but still wholly without definition or identification. It is full of nutrients, too; in fact, it has been found that the natives of some Southern climes virtually live upon the fruit of one of the crude, partly-developed cacti, and maintain a truly Japanese vigour.

But Mr. Burbank opens one more fruit. This time the longitudinal slit of the knife reveals a golden meat wholly different in flavour. Each fruit is in form like a fat cucumber flattened at the ends, say two-and-a half inches in diameter by three-and-a-half inches in length.

One of the more highly-developed plants, grown to gigantic stature in three years, has over six hundred pounds of nutritious food for man and beast

upon it, and as you look upon this one plant and think of the vast multiplication of it now possible, you begin to see something of what is to come to pass in the reclamation of the waste places of the earth. You call to mind the quotation which he made to a friend as he looked out upon the future of this, but one of the hundreds upon hundreds of works he is engaged upon for the welfare of man: "The wilderness and the solitary place shall be glad for them; and the desert shall rejoice and blossom as the rose."

I asked Mr. Burbank if there might not be in this wonderful growth something of interest to the paper-maker: might not the leaf contain a prodigious amount of cellulose fibre suitable for manufacture into paper?

"No," he said, "that is precisely what I have bred out of it. I am making it an intensive, as well as an extensive, food, eliminating as far as possible the cellulose as it appears in woody, fibre-like material, and making the whole plant, from root to crown, a reservoir of food. Nature will do her part always. She never lies; she never deceives; but often, in the sight of man and from his standpoint, she fails. She failed, in this negative sense, in giving to the cactus the thorns and spicules. Nature has her secrets, her disappointments, if you will, and you must listen close to her great heart if you will hear them; then with all haste and power come to her aid. In the cactus very much, from our point of view, was wasted on the spicules and thorns. I have simply helped her by taking away from her the necessity of producing them, and have left her free to put all her energy upon producing food. It is food, not fibre, that I have sought in the cactus."

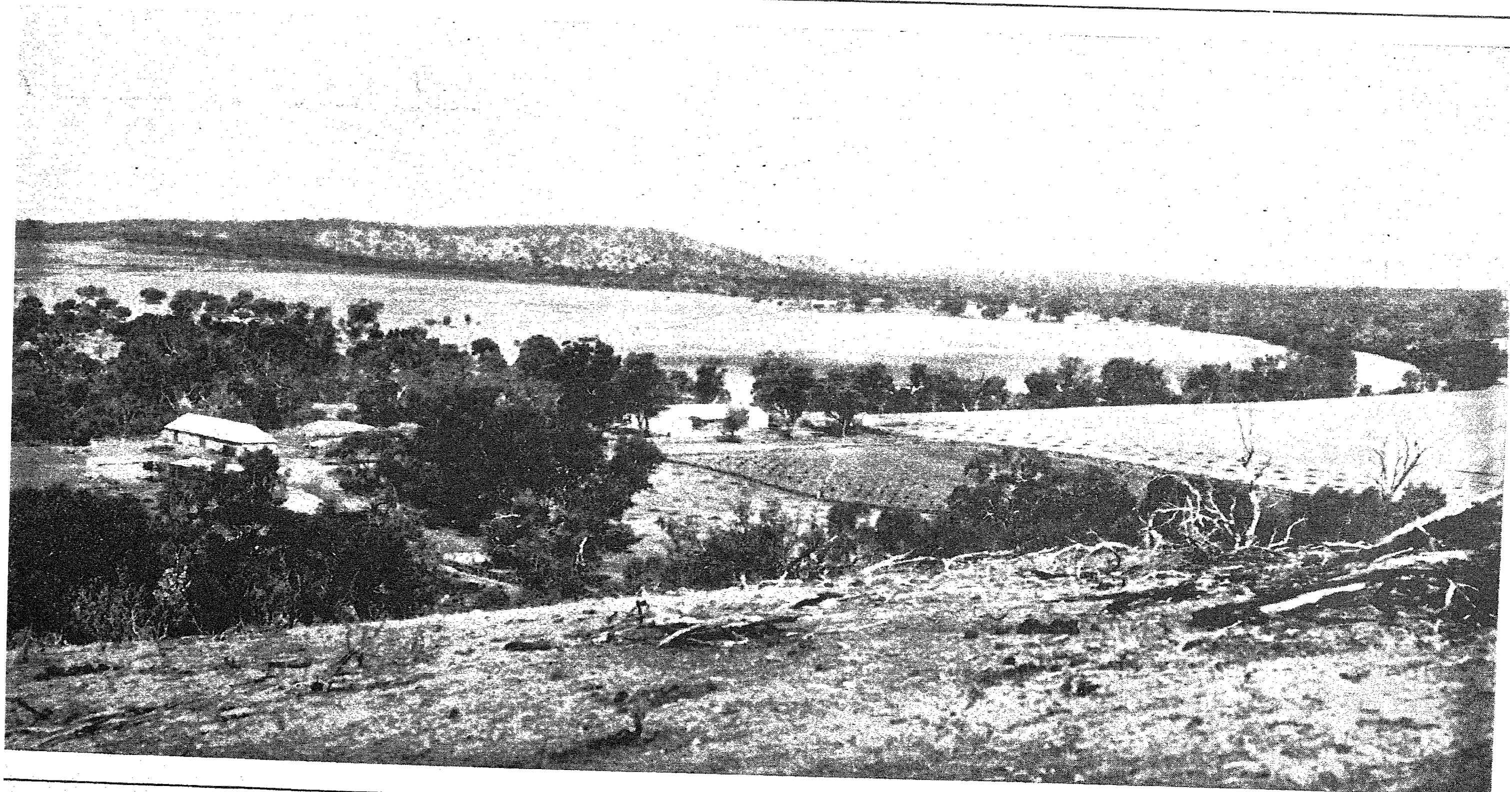
The cactus now becomes a definite practical food. It may be eaten raw or cooked. The leaves may be put up and preserved as ginger or melon rinds or citrus. They may be eaten in a variety of ways, while the fruit itself will prove one of the delicacies of the markets.

But not only has the constitution of the cactus plant been cared for so that it needs only to be adopted by the world to become a new source of food supply, but it has in the meanwhile been made so hardy that it will endure the coldest climates; it may be grown from the equator to the pole, or as far north as any vegetation can be produced. The new plants preserve their type also, never reverting, but always persisting. There is apparently no degeneracy, no return to its coat of mail, but a steady persistence in its new life-habits and its physical structure.

It is a most curious plant too, in that it will grow alike from seed or leaf. All that is needed is to put part of a thick leaf into the soil or even to throw it down and let it dry in the sun; in due season it will root itself and spring into green life. Strangely enough it will grow upside down with little consideration for the conventionalities of plant life.

Mr. Burbank's talk about the cactus has a whimsical quality characteristic of the man. He says:—

If we invite Mr. Thistle or Mr. Catcus into our gardens and patiently and earnestly teach and thoroughly convince him that all the marauding animals shall be kept out, it will not be very long before some member of his tribe will see fit partly to discard some of those exasperating pins and needles and put on a more civilised suit of clothes; and by further careful selections from this one varying individuals others are produced which are absolutely spineless, to remain so as long as the marauding animals do not disturb them, often becoming useful members of our parks and gardens. It



GWAMBYGINE.

J. Hicks' Homestead. Holding, 978 acres.

is a great effort on the part of the plant to produce all these spines, and when this effort is made unnecessary the plant will at once become more docile and pliable, and can be easily led into almost any useful occupation in which plants are employed.

Roses, blackberries, raspberries, and gooseberries can also be made as free from thorns as strawberries or apples are, by the same education and individual selection. At present, however, the authors of new fruits and flowers are fully employed in improving the size, abundance, and perfection of form, colour, and fragrance in flowers and the abundance and lusciousness of fruits, otherwise the thorns would have been eliminated long ago.

Apropos of this, Mr. Burbank asked me to bend over a blackberry bush and rub the thorny stem against my cheek. To my surprise the thorns were gone. Out of thousands of plants he has selected and bred until now, he has a blackberry without thorns.

Among his many creations the regenerated cactus promises to do more in a material way for the world than anything he has yet done, not excepting the potato that bears his name, a product of his boyhood days. This potato yielded him 125 dollars. It has already added greatly to the nation's wealth.

(*To be continued.*)

THE PARASITE HUNTER.

Under the above heading there appears in the *Daily Mail* (London), of June 16th ult., the following interview with Mr. George Compére, the Government Entomologist:—

"He had just arrived in London from Brazil, and was off next day to the Antipodes. I found him in the office of the Agent General for Western Australia. He was carrying a little box, containing a few commonplace-looking beetles. Yet to find those beetles he had travelled fifteen thousand miles, and had searched far and wide.

"For the bronzed and hardy traveller follows the least known profession on earth, that of the parasite hunter. Two governments—Western Australia and the State of California—employ him at this work between them. For years he has been travelling, literally from China to Peru, in his search for insects that will aid the farmer in his war against pests.

Colorado and other Beetles.

"What is a parasite hunter? 'I am a tracker down of the natural cures for the insect pests that are doing damage, costing hundreds of millions every year,' said Mr. Compére, in answer to my questions. 'Every country has its different plagues. The San José scale sweeps orange plantations bare; the codlin moth does damage among apples in America alone to the value of seventy-five million dollars a year. A generation ago the Colorado

beetle threatened the world's potato crop. At the present time a large part of the State of Massachusetts is mainly taken up in trying to exterminate the gipsy moth, which has destroyed vegetation wherever it has spread. In the Southern States the boll weevil threatens the cotton crop, and by the damage it did helped to make the shortage in cotton that closed Lancashire mills not long ago.

"'How do these pests come? Here, London, affords you the simplest illustration. Millions of insects are carried into England every day in the merchandise that arrives from abroad, some in the sackings of Eastern cargoes, some in the dried foliage around tropical produce. At any time one of these strange insects, carried here in such fashion, might find that the English climate suited it, and that one of your native products (possibly wheat) supplied it with a suitable food. If there were nothing to counteract it, it would in a few years spread all over England, breeding in great numbers several times a year. Before many had quite realised what was the matter, your wheat crop would be ruined.

"'This is not an extravagant illustration. The same thing has happened, in other lands, many times over. What, in such case, could you do? The old cure, still largely adopted, is to attempt to destroy the eggs of the insect, and to fight it by fumigations and dressings of various kinds. The 'paraffin brigade,' as I call it, has many adherents. But its method is not really effectual, for if you leave only a few of the pests behind you may have all your trouble over again.

"'Some of us in California thought out a different plan. We were impressed by the fact that the same insect which ruins the whole country-side in one land does no appreciable damage in another land. Why is this? We found on examination that the pest of one land is kept in check in its native home by a parasitic insect that preys on it. The reasonable method of attack seemed to be not to try to kill your pest by paraffin, but to breed the rival insects that would kill it.

Set a Thief to Catch a Thief.

"'On these lines I have been working for some years. At first my work was done under the direction of the State of California. Then the Government of Western Australia commissioned me, and my recent work has been done for both these States in conjunction. Thus I represent the Anglo-American Alliance in my own person. It seems that your Home Government has left enterprise here to one of your outer parts, for when I went to your Government institutions in London to learn what they were doing along the same lines, they looked at me with amazement, as though the idea of fighting living creatures with living creatures had never occurred to them. Yet England has the blight on her hops and the pests that ruin her orchards, like elsewhere.

"'For some years my work has taken me to every land. Now I am in Spain, now in China, now in the heart of France, now in Central America. I am never ill, even with fever, and on my travels drink nothing but water. My method is this: When seeking an antidote I first find the native home of the pest I wish to attack. Then I go there, get into the country and examine. I watch the same pest there (where it is probably doing scarcely any damage), and I am almost sure to find that at some stage of its life another insect attacks and destroys it. Then I have found what I wanted—my parasite—and I take it away with me and breed it to fight the pest.

MOTH EATEN BY WASPS.

"'Naturally, difficulties sometimes crop up. When farmers see a stranger, who cannot speak a word of their language, poking about their grounds, they are apt to be suspicious. The French peasants are the worst I know in that way, and have a firm belief that every inquiring visitor is seeking to take from them their secrets of success. Sometimes religious scruples hinder me. Thus I once found an insect I had been looking for on a small tree in a Chinaman's garden. But the Chinaman would not sell the tree on any terms owing to some ancestral or religious objection. I had to have it, but there was no overcoming the man's objections. I carried it away in the end—don't ask how.

"'Some time ago I was making investigations in Spain, when I noticed some codlin moths on apple trees there. The codlin, as I told you, does widespread harm to American apples. The Spanish farmers told me, however, that it did no harm to their orchards. It came on me like a flash that I would here discover the parasite for the moth. After some investigation I found one particular kind of wasp which lived off the moth and kept it down. I secured specimens, and the wasp is being bred in America now, to destroy the moth there.

"'Of course, such work has many disappointments. Thus I brought some fruit fly parasites back from Bahia to London. I packed up a large number in one consignment. On opening them in London I found that only three were left. The beetles had turned cannibals and eaten each other on the journey.

"'Every pest has its parasite, and the right way to fight pests is through their parasites. Western Australia is setting the way here in practical fruit culture and farming, and others will benefit from its work.'"

GARDEN NOTES FOR AUGUST.

By PERCY G. WICKEN.

The season, so far, has been an exceptionally early one, and all vegetation is very forward, and, should the rains extend well into the summer, the season should be a prosperous one. The statistics for the past year have just been made available, and from them we gather that the production of potatoes for the year ending 28th February, 1905, was 5,593 tons, while for the previous year the total was 4,542 tons, showing an increase for the year of 1,051 tons, or, roughly, about 300 acres more under crop. On the other hand, onions have decreased, the total produced being only 242 tons, as against 342 tons in the previous year, or a decrease of 100 tons.

Kitchen and market gardens are also set down under separate headings, the areas being given as kitchen gardens 852 acres and market gardens

3,354 acres. The cultivation of onions require considerable care and attention, but the results obtained from the crop well repay for the labour expended on it.

As soon as possible after the heaviest of the winter rains—which generally fall in July—have passed over, the land should be got in readiness for planting out summer vegetables, and a great number of plants can be sown during August in almost all parts of the State, while in the warmer districts, about Geraldton, all kinds of summer vegetables, such as tomatoes, cucumbers, etc., are well forward, in many instances being transplanted out in June. It is the early-grown fruit or vegetable of each class which secures the best price on the market, and, as a rule, brings in the greatest percentage of profit to the growers; consequently those in the warmer districts are often able to obtain better prices for produce than those further south, as the produce is fit for market earlier. In the more southern districts, where it is impossible to get early produce to send to market, the object should be to obtain it as late as possible, when it is again getting scarce. Produce coming in during the height of the season, when the market is probably glutted with supplies, always secures a low price, and often the margin of profit is very low. Nitrogenous bacteria, for the purpose of enabling the leguminous crops to take their supplies of nitrogen from the air, will be shortly obtainable in Perth. A quantity of the bacteria suitable for garden peas has been prepared and distributed by the Department of Agriculture to various applicants, but the supply is now exhausted.

Manure should be dug into the soil and the ground prepared for planting out on, care being taken that the same species of plants are not planted on the same ground as last year, a rotation being always conducive to the best results; thus, plant peas where the root crops were last season, and cabbages where the peas were, and roots where the cabbages were. By this means the fertility of the ground is improved, and insect pests kept in check.

ASPARAGUS.—As soon as the plants show any signs of growth they should be planted out, in land which has been suitably prepared, by digging in trenches about 30 inches deep, and well mixed with stable manure. When planting, all damaged parts of the roots should be cut away; a ridge should be left in the trench so that the centre of the plant is higher than the sides, and to allow the roots to be spread out in their natural position; fill in with fine soil, so that the top of the crown is covered with about two inches of soil; then press firmly down, and take care not to injure the roots.

ARTICHOKES (Globe).—Plant out suckers or young plants from the seed bed. They require good soil, and as they grow to a good size they should be put out about three feet apart each way.

ARTICHOKES (Jerusalem).—Can be sown in almost all parts of the State this month. They are hardy, and make an excellent vegetable, and the surplus can be used for pigs. The tubers are cut into pieces and planted in drills about three feet apart and about 18 inches apart in the drills, and cultivated the same as potatoes.

BEANS (French or Kidney).—In the warmer districts the early sown beans will be well forward; in the central districts they can be planted largely, while further south it is still too cold. Obtain good seed, and plant out in rows three feet apart in ground that has been previously well manured, and supply a little superphosphate at the time of planting the seed.

Beet (Red).—Sow a small supply of seed to keep up a supply. The drills should be 18 inches apart, and the seed covered about one inch deep. The globe varities are the best.

Beet (Silver).—May either be sown direct in the drills or raised in a seed bed, and transplanted later on. This is an excellent plant for dry districts, and supplies a quantity of succulent green leaves all the summer. The outer leaves are used as required.

Cabbage.—Plant out any suitable plants you may have, and a little more seed may be sown for planting out later on.

Carrots.—Sow seed in well prepared land which has been well manured for the previous crop; fresh manure applied to this crop caused the roots to become forked. Sow seed in drills 18 inches apart, or in double rows three feet apart. The latter method allows of horse cultivation between the rows.

Celery.—Sow a little seed to keep up a supply, thin out the seed beds already up so as to obtain good plants for transplanting. Any forward plants should be put out in well manured trenches, and as the plants grow they should be earthed up to keep the light away, and cause the plants to bleach.

Cucumbers and Melons.—In warm localities, where danger from frost is past, seeds may be sown in the open, but in other parts they will require to be raised under cover or protected at night.

Leeks.—Plant out any healthy seedlings that are available and put in a little seed for future use.

Lettuce.—Plant out all seedlings that are strong enough and sow a little seed for future use.

Onion.—Plant out all available healthy plants and also sow a quantity of seed. A lot of money is sent away every year for onions that might be raised in the State. The land should have been previously well prepared and worked to a fine tilth. During the early stages of growth the weeds will require constant attention or they soon choke the young onions.

Peas.—Sow large quantities of peas, a few rows at a time, so as to keep up a succession, they are always in good demand. The earlier sown plants will require staking for garden purposes, but where large areas are grown this is not done, on account of the labour involved. When peas are staked the yield is heavier and the picking of the pods rendered easier.

Potatoes.—May be planted in districts where danger of frosts is over. In fact in the more northern districts can be sown at almost any time. Select good seed free from scab and from the grub of the potato moth, which does serious damage to the crop, and do not plant on land that had potatoes on last year. Cut the tubers so that two or three eyes remain on each piece and plant in rows three feet apart and one foot apart in the rows.

Sweet Potatoes.—Prepare a seed bed and take out the top four inches of soil and place on one side, lay the tubers side by side in this space and then place the earth back on the tubers. In a few weeks' time the tubers will send out a number of shoots and these are taken off and planted out. Prepare land ready to plant out the shoots later on and get it ridged into hills.

Tomatoes.—In the warmer localities plants that have been raised in the seed-beds may be planted out. In the northern parts this has been done some time ago, but as we come further south the season is later. Sow a further supply of seed for planting out later on. Only the smooth-skinned best varieties should be planted, as, owing to the plentiful supply available during the season, only the best varieties will command a sale and yield a profit to the grower.

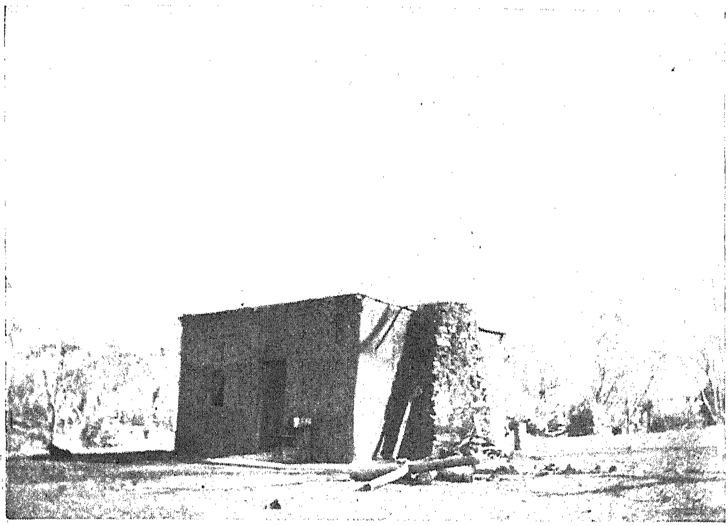
Farm.—The season has been so wet that in the southern districts seeding operations have been very much delayed, and the area under crop will fall somewhat below expectations. In the eastern districts the crops look well and promise good results. This is somewhat a slack month on the farm, and advantage should be taken of the lull in out-door operations, after seeding, to get all the odd jobs about the place done—fences repaired, gates fixed up, etc., If the weather keeps fine, burning off should be pushed on with so as to get as much as possible done before the close season prevents this work being carried out. Potatoes can be planted in almost all parts of the State this month, and every farm should grow a small area of potatoes, if only sufficient to provide for their own wants. Mangels and sugar-beets can also be sown, and make excellent summer food for stock. Hungarian Millet, as a quick-growing fodder, should be planted at once, and if not required for green feed can be made into hay. Jerusalem artichokes and arrowroot are worth growing to supply the pigs with food. Grass seeds are better sown earlier, but, if not already sown, seeds of paspalum dilatatum and Rhodes grass should be planted at once. In the more northern areas seeds of cow-pea, lima bean, melons, and pumpkins should be sown. As soon as the grass in the grazing paddocks begins to grow it will be an improvement to run the harrows over them and distribute the manure and rubbish.

LOCAL MARKETS' REPORTS.

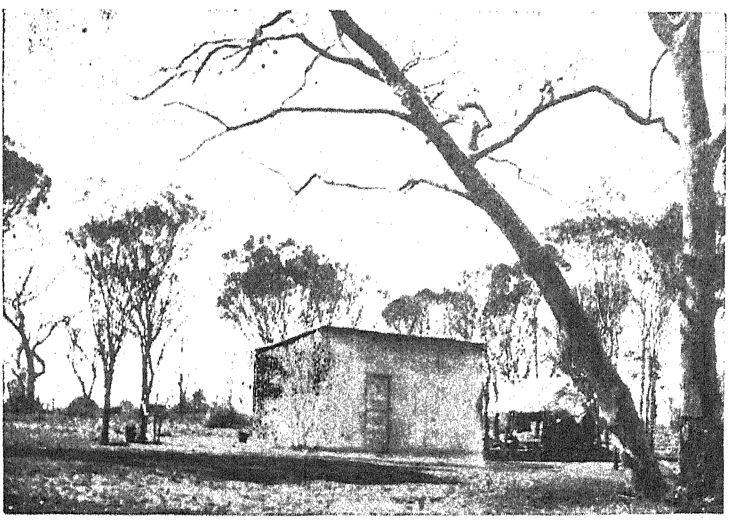
Messrs. PATERSON & CO.'S (Ltd.) REPORT.

Messrs. Paterson & Co., Ltd., report as follows in connection with their produce and other trades of interest to the farming community:—

Chaff.—The Perth market has not fluctuated greatly during the last month, and in spite of the Government estimate, indicating an apparent shortage for the season of about 8,000 tons of hay, there has been no strong upward movement. Last month's value of prime green wheaten chaff was £5 to £5 2s. 6d. Perth, with an occasional sale at £5 5s. The quantity of stored chaff in Perth and Fremantle has now been very considerably reduced, but even the farmers' seeding operations have not brought about an advance. In fact, the market throughout June may be called £5 for prime, with a few trucks occasionally at £5 2s. 6d., and towards the end of the month prices broke to the extent of about 7s. 6d. This brought about no falling off of supplies, for the quantity of chaff offering at Perth and Fremantle lately has been



A. Batty's Farm. Holding, 548 acres; all fenced; 60 acres cultivated; 150 acres ring-barked.



J. Sheanhan's Farm. Holding, 226 acres; all fenced; 35 acres under cultivation; 85 acres ring-barked.

considerable. In the face, however, of free supplies, the market has steadied to the extent of about 5s. per ton. We see no occasion at present to look for much movement one way or the other for the rest of the season, but it is possible that, once seeding operations are over, farmers may increase their railings to the metropolitan market, which would doubtless bring back prices, especially if much damaged chaff comes forward. Really prime green wheaten has been conspicuous by its almost total absence, the best of what is now arriving not being really of first-class quality. Present value of prime wheaten chaff is, say, £5 Perth, while f.a.q. is worth £4 15s., and good medium £4 7s. 6d. to £4 12s. 6d. Much of the chaff recently to hand, however, has been damaged, and has been sold at from £3 to £3 15s. per ton. There has also been a good deal of chaff damaged in the cutting, through being too much broken up and dusty, and this is worth about £4 10s. Perth. Fremantle has been a better market lately for slightly off qualities, and we have sold freely. Holders should bear in mind that it is to their disadvantage to rail chaff in bogie trucks, as these are more difficult to sell, frequently to the extent of 2s. 6d. per ton. Oaten chaff is worth £4 15s. to £5 Perth for a good sample, of which there has, however, been little to hand of late.

Wheat.—The firmer tone in the market has continued, although the shipping value of cargoes has not advanced, according to the latest London advices. The value of wheat c.i.f. London is, say, 31s. to 31s. 6d. per quarter. We have sold a good deal of milling wheat at 3s. 6d. on rail at country stations, and possibly a fraction more might be obtained at present, especially as all the wheat now in the country appears to be fairly firmly held.

Oats.—There have been very few local oats on the market of late, and virtually all the business in feed oats has been done in imported Algerians, New Zealands, and Tasmanians. Melbourne market is, say, 1s. 7½d. to 1s. 9½d. for good feed to milling qualities. Tasmanians are up to 2s. 4½d. f.o.b. Devonport, and business has been done in New Zealands at up to 1s. 9½d. for f.a.q.

Bran and Pollard.—Markets are fractionally easier, due doubtless to some extent to millers being now in a better position to overtake their contracts, and also to the increased amount of green feed available during the winter months. Present values are £6 to £6 5s. on rail York or Northam for bran and pollard. The Sydney and Melbourne markets are both about 9¼d. to 9½d. and 10d. for bran, with pollard at 10¼d. and 11d. Adelaide is quoting 11¼d. for both bran and pollard.

Gunnies.—The Calcutta market has steadied during the last few weeks, but the latest cables to hand contain no reliable indication as to the probable future of the market. The future of prices will depend mainly upon the result of the jute crop, which cannot be known for some time yet. In the meantime we have put through a large amount of business in bran bags and corn sacks. Spot values are 4s. to 4s. 1d. for bran bags and 5s. 10d. to 6s. for corn sacks. Woolpacks, 11¼lbs., are worth about 2s. 2d. to 2s. 3d.

Fencing Wire.—Stocks on spot appear to be light, particularly of galvanised, which has been selling somewhat freely. We see no reason to look for any material change in fencing wire in the near future.

H. J. WIGMORE & CO.'S REPORT.

Messrs. H. J. Wigmore & Co. report as follows in connection with their daily sales of produce, held at Perth and Fremantle:—

Chaff.—In connection with our daily auction sales of chaff in Perth and Fremantle we have to submit the following report for month ending 8th instant:—Supplies have been fully maintained during the month, especially of medium and low grade chaff, and, as a consequence, these qualities have somewhat receded in value. Indeed at times auctioneers have had great difficulty in quitting chaff below good medium quality at anything like reasonable figures. Again and again chaff of this description has been passed in at auction, and has been sold privately by us at our valuations. We strongly urge farmers to cease sending in any chaff below f.a.q. for a few weeks, when the market must, in our opinion, regain its former tone. There has been little or no alteration in prime chaff, and we have sold dozens of trucks during the month at prices ranging from £5 to £5 2s. 6d. Careful inquiries

have been made by us and we are still of the opinion that later on the shortage which we are satisfied exists, especially in f.a q. and prime qualities, will be keenly felt long before the new season's stuff is available. Many hold that there is sufficient chaff to carry us over till next season, but we do not share this opinion, and we base our decision on the reports we have received from authoritative persons residing in many different districts. Bunbury has been drawing freely from Northam during month now under review. Chaff has been railed by us to Brookton, and we know of considerable supplies having been railed to Narrogin. We still have nearly four months to go, and it is obvious that in these districts at least chaff must be very difficult to obtain or buyers would never rail from such distances as Perth and Northam to their respective centres. During the month there has been much trouble owing to the damage which necessarily follows such heavy rains as we have recently experienced. We strongly advise farmers holding chaff not to be anxious about the market, as, if our inquiries are correct, there can be no doubt of considerably higher values ruling before long. A feature of the market also is that stored chaff, when we last reported to this *Journal*, amounted, approximately, to between 300 and 400 tons, has now been so cleared out as to amount to considerably under 100 tons. The goldfields prices slumped considerably owing to heavy supplies, but the loss has been almost entirely regained, and to-day the Kalgoorlie market rules at about £6 5s. to £6 7s. 6d. for prime. We look for a steady demand from the goldfields for some time to come, and we very much doubt if there will be another glut before the new season's chaff is on the market. The Fremantle market during the last week has been somewhat firmer, and we have realised repeatedly for good medium £4 17s. 6d. We do not advise consignments to Fremantle, however, as the market is so small that a dozen trucks will fill it and prices ease accordingly. We quote values as follows:—F.a.q. to prime wheaten £5 to £5 2s. 6d.; f.a.q. wheaten, irregular, £4 15s.; good medium wheaten, £4 12s. 6d.; medium wheaten, £4 10s.; inferior wheaten and cow chaff, from £3 15s. upwards; f.a.q. oaten, £4 10s.; medium and inferior oaten, from £4 upwards. The outlook for next season is good, and doubtless the dry spell during June will mean a very much greater acreage put into crop than was expected during the heavy rains of May.

Wheat.—Since our last monthly report has firmed still further, this confirming our predictions. Value for prime milling is now 3s. 9½d. to 3s. 10½d. at auction in Perth, and we have no doubt that before long 4s. will be readily obtainable. Inferior and weevily sorts sell according to their condition and quality. It is extremely difficult to secure wheat, and we invite correspondence from those holding, and are quite prepared to sell either privately or by auction, as directed.

Straw.—Some little business has been done during the month at £2 7s. 6d. on rails, Perth or Fremantle.

Hay.—We have no business to record.

Bran Bags firmer, and we have made our usual sales to farmers during the month. To those wanting we shall be pleased to quote.

Flour.—Prices remain as last reported, viz., £8 7s. 6d. for Thomas' Standard on rails Northam, and £7 12s. 6d f.o.b. Port Adelaide, at which prices we have done heavy business.

Oats, Seed.—The demand has nearly fallen away, and we have to report that stocks are almost entirely cleared.

Algerian Feed.—No local supplies during the month, Victoria continuing to supply requirements. Values are firming in Melbourne, and we quote:—For heavies, for prompt shipment, 1s. 8d. to 1s. 8½d.; good milling, 1s. 9d. to 1s. 9½d. On spot 2s. 4½d. to 2s. 6d. for good feeds, whole and crushed respectively, on rails Fremantle. We have sold heavily f.o.b. Melbourne during the month.

Stouts.—Tasmania is almost cleared out, and prices for f.a.q. range from 2s. 3d. to 2s. 4½d., with a brisk demand. Importers have had to look to New Zealand for a considerable portion of their supplies, and we quote:—B grade oats, 1s. 9½d. to 1s. 10d. f.o.b. Bluff; and C.'s, 1s. 9d. to 1s. 9½d. On spot stout oats are worth 3s. 3d. to 3s. 4d. whole; crushed, 1½d. extra.

Bran and Pollard.—An easier feeling has prevailed in these commodities during the month, but our supplies at Northam continue very light. We quote:—£6 5s. for both bran and pollard, subject to stocks. On spot bran is worth £6 10s. to £6 12s. 6d. rails Fremantle, and pollard about the same money.

THE CLIMATE OF WESTERN AUSTRALIA DURING JUNE, 1905.

On the whole this was a fine weather month. Showery weather prevailed in West and South-West districts till the 9th, with heavy coastal squalls and rough seas, but from the 9th till the 28th only one of the usual winter disturbances passed along. During this period anti-cyclonic conditions prevailed, viz., high barometers, fine, bright weather, and cold frosty nights, especially inland. One disturbance, not of the usual type, must be recorded. On the 24th the weather became cloudy to overcast throughout the State, and rain fell on the North-West coast between Condon and Cossack. The unsettled weather passed thence across the desert country in a South-East or South-South-East direction towards South Australia, being felt only at our most Eastern settlements, but in South Australia a heavy downpour was recorded, extending from the centre of the continent to the South coast. This, though having very slight effect in Western Australia, deserves mention, as we are only just commencing to appreciate the importance of this class of disturbance in Australian meteorology.

On the 28th an ordinary winter storm visited the South-West district, and the weather remained showery and squally till the end of the month.

On the whole, pressure was above the average for previous years, only slightly in the tropics, but considerably so in Southern portions. Temperature was about normal in the day time, but lower than usual at night, frosts were fairly frequent in the middle and latter portions of the month, especially inland. The lowest temperature on the surface of the ground was 22·0 at Southern Cross and Walebing on the 19th.

Rain was below the average throughout, but especially near the North-West Cape, where only a few light showers fell. In the extreme South-West it was fairly heavy, but in no district did it quite reach the normal.

The following table shows the mean and absolute lowest temperatures recorded by a thermometer placed upon the surface of the ground:—

Station.	Mean.	Lowest.	Date.
Peak Hill	36·0	26·0	22
Cue	39·5	31·2	27
Coolgardie	35·9	24·2	18
Southern Cross	34·1	22·0	19
Walebing	33·5	22·0	19
York	35·3	24·4	19
Perth Observatory	44·0	32·0	22
Wandering	35·0	26·0	26, 27
Bridgetown	35·1	26·0	27
Karridale	38·1	24·3	27
Katanning	36·5	25·0	17, 18
Mount Barker	36·9	29·0	19

The Climate of Western Australia during June, 1905.

	Locality.	Barometer (corrected and reduced to sea-level).				Shade Temperatures.									Rainfall.		
						June, 1905.					*Average for previous Years.						
		Mean of 9 a.m. and 3 p.m.	Average for previous years.	Highest for Month.	Lowest for Month.	Mean Max.	Mean Min.	Mean of Month.	Highest Max.	Lowest Min.	Mean Max.	Mean Min.	Highest ever recorded.	Lowest ever recorded.	Points (100 to inch) in Month.	Wet Days.	Total Points since Jan. 1.
North-West and North Coast:	Wyndham	30·022	30·010	30·160	29·844	87·6	67·5	77·6	97·8	59·0	86·8	67·1	96·0	54·0	*Nil*	*Nl*	1,080
	Derby	30·026	30·009	30·179	29·882	86·3	57·7	72·0	92·4	45·2	85·2	61·3	96·0	48·0	62	1	1,367
	Broome	30·030	30·025	30·179	29·878	82·8	57·8	70·3	90·3	48·5	82·1	60·1	96·9	48·4	46	1	536
	Condon	30·074	30·053	30·255	29·899	77·2	52·3	64·8	87·2	41·3	77·8	53·3	87·0	38·8	91	1	537
	Cossack	...	30·060	30·254	29·966	76·4	56·6	66·5	84·0	46·2	76·2	57·2	88·8	47·6	111	3	761
	Onslow	30·085	30·047	30·250	29·930	77·0	52·0	64·5	87·0	42·0	76·7	55·1	87·0	38·5	9	2	482
	Winning Pool ...	...	...	...	...	...	...	...	...	...	...	...	...	...	5	1	761
	Carnarvon	30·138	30·071	30·311	29·953	73·7	55·0	64·4	85·7	41·5	72·9	52·8	83·9	38·2	101	2	937
	Hamelin Pool... ...	30·145	30·078	30·320	29·910	70·5	48·0	59·2	79·0	33·4	69·5	51·7	79·8	36·2	81	3	639
	Geraldton	30·168	30·080	30·370	29·854	70·3	51·0	60·6	80·0	39·0	69·3	52·6	79·2	34·7	238	9	953
Inland:	Hall's Creek	30·111	30.090	30·256	29·946	81·9	45·9	63·9	91·5	38·5	80·0	50·8	89·5	33·1	*Nil*	*Nil*	488
	Marble Bar	...	...	...	...	77·9	56·1	67·0	88·0	43·8	79·4	53·6	92·0	40·5	27	2	795
	Nullagine	30·144	30·090	30·350	29·926	74·1	47·3	60·7	84·0	32·0	74·7	48 0	89·8	32·7	45	1	466
	Peak Hill	30·190	30·120	30·430	29·940	65·0	44·0	54·5	77·0	37·0	65·9	47·7	77·8	37·5	4	1	379
	Wiluna *	30·188	30·149	30·437	29·923	65·0	39·9	52·4	77·8	29·3	65·7	43·4	78·7	31·5	18	2	490
	Cue	30·202	30·120	30·422	29·952	65·7	44·1	54·9	76·2	35·2	65·5	46·8	78·0	34·0	31	3	538
	Murgoo	...	...	...	...	67·1	43·3	55·2	79·0	34·0	...	...	...	...	43	2	337
	Yalgoo	30·184	30·101	30·406	29·905	65·9	43·8	54·8	78·0	33·0	65·0	46·2	79·9	32·9	35	3	489
	Lawlers	30·214	30·127	30·470	29·970	64·0	42·3	53·2	75·3	33·2	63·3	45·0	76·2	33·7	1	1	557
	Laverton	30·222	30·175	30·499	29·893	62·9	40·3	51·6	75·3	30·5	63·2	42·8	78·1	29·4	15	1	605
	Menzies	30·205	30·114	30·469	29·915	62·0	41·2	51·6	72·6	34·0	62·0	45·2	75·6	33·8	30	1	335
	Kanowna	...	...	...	...	60·3	39·9	50·1	71·8	30·3	...	...	...	...	28	...	358
	Kalgoorlie	30·206	30·110	30·489	29·855	61·9	42·9	52·4	71·9	35·4	61·5	45·7	76·4	34·0	30	3	360
	Coolgardie	30·204	30·108	30·487	29·844	61·5	42·1	51·9	70·0	34·2	61·3	44·4	78·3	31·5	50	4	431
	Southern Cross ...	30·200	30·080	30·476	29·882	63·1	38·2	50·6	71·0	28·0	62·2	42·6	79·0	28·0	30	2	339
	Kellerberrin	...	...	...	...	...	...	...	...	...	...	...	...	...	137	7	537
	Walebing *	...	...	...	...	62·5	39·5	51·0	72·0	29·0	62·9	43·4	73·5	30·0	223	12	847
	Northam	...	...	...	...	63·1	44·2	53·6	72·0	30·0	63·8	40·4	73·1	29·6	197	9	740
	York	30·186	30·084	30·458	29·751	62·7	39·8	51·4	70·2	28·4	63·2	42·8	76·0	30·4	191	12	854
	Guildford	...	...	...	...	63·2	43·6	53·4	73·4	34·2	65·0	45·5	72·0	30·2	395	12	1,439

* Averages for three years only.

The Climate of Western Australia during June, 1905—*continued.*

Locality.	Barometer (corrected and reduced to sea-level). Mean of 9 a.m. and 3 p.m.	Barometer. Average for previous years.	Barometer. Highest for Month.	Barometer. Lowest for Month.	Shade Temperatures. June, 1905. Mean Max.	June, 1905. Mean Min.	June, 1905. Mean of Month.	June, 1905. Highest Max.	June, 1905. Lowest Min.	*Average for previous Years. Mean Max.	*Average. Mean Min.	*Average. Highest ever recorded.	*Average. Lowest ever recorded.	Rainfall. Points (100 to inch) in Month.	Rainfall. Wet Days.	Rainfall. Total Points since Jan. 1.
South-West and South Coast:																
Perth Gardens	30·166	30·094	30·455	29·651	63·6	47·5	55·6	71·0	39·8	64·2	47·3	72·6	37·4	452	10	1,501
Perth Observatory ...	30·181	30·070	30·461	29·628	64·2	48·2	56·2	72·7	39·0	63·6	49·1	73·2	36·9	467	12	1,549
Fremantle	30·198	30·060	30·468	29·697	64·4	51·3	57·8	72·2	43·5	64·1	51·8	73·0	40·0	283	11	1,120
Rottnest	30·178	30·046	30·440	29·612	63·6	53·7	58·6	70·2	48·0	63·3	54·2	71·0	42·4	293	13	1,190
Mandurah	...	...	...	...	63·7	45·8	54·8	71·0	33·3	64·3	46·6	73·2	33·4	538	12	1,795
Marradong	...	...	...	...	...	...	...	...	...	...	...	...	...	377	9	1,414
Wandering	...	...	...	...	61·6	39·3	50·4	68·0	30·0	...	...	...	...	341	8	1,257
Narrogin	...	...	...	...	57·8	40·9	49·4	65·0	32·0	...	...	...	...	268	10	1,174
Collie	...	...	...	...	61·0	37·1	49·0	69·1	27·2	60·9	37·8	68.0	37·6	531	15	1,688
Donnybrook *	...	...	...	...	62·4	42·2	52·3	70·9	31·3	62·4	42·5	69.2	31·0	658	13	2,002
Bunbury	30·174	30·056	30·464	29·677	63·3	46·7	55·0	67·8	38·5	63·9	48·2	73·7	35·2	521	15	1,610
Busselton	...	...	...	...	62·7	44·9	53·8	67·0	33·0	62·6	45·6	71·0	31·0	468	15	1,355
Cape Naturaliste ...	30·136	...	30·437	29·566	61·1	51·7	56·4	68·5	45·5	...	...	...	...	409	14	1,348
Bridgetown	...	...	...	...	60·8	39·0	49·9	69·2	27·0	61·4	39·4	69·2	26·6	444	15	1,448
Karridale	30·094	30·025	30·408	29·548	62·5	45·5	54·0	70·0	31·2	62·5	47·9	76·0	31·6	684	20	2,384
Cape Leeuwin	30·086	29·978	30·433	29·381	62·1	49·0	55·6	68·6	46·2	62·3	53·5	70·2	46·4	659	21	1,946
Katanning	30·173	30·054	30·475	29·560	59·3	42·4	50·8	66·2	30·0	59·2	42·4	71·5	29·5	375	17	974
Mt. Barker	...	...	...	...	58·1	41·9	50·0	63·5	33·5	...	...	...	...	253	19	1,328
Albany	30·122	30·013	30·434	29·465	61·3	45·3	53·3	69·8	35·8	61·5	46·1	73·5	35·4	429	20	1,573
Breaksea...	30·120	30·011	30·467	29·467	60·2	50·0	55·6	70·5	39·5	60·2	50·9	72·4	41·0	487	23	1,633
Esperance	30·162	30·044	30·534	29·816	63·3	45·3	54·3	72·8	36·0	63·7	47·7	76·9	35·5	203	13	1,387
Balladonia	30·208	30·129	30·527	29·761	62·0	40·9	51·4	73·7	29·2	62·6	43·2	75·0	29·8	32	2	381
Eyre	30·155	30·097	30·494	29·697	65·1	42·5	53·8	76·6	29·5	64·5	46·5	78·6	29·0	68	10	429
INTERSTATE.																
Perth	30·181	30·070	30·461	29·628	64·2	48·2	56·2	72·7	39·0	63·6	49·1	73·2	36·9	467	12	1,549
Adelaide	30·174	30·124	30·560	29·567	59·6	47·8	53·7	64·2	40·9	60·3	46·7	76·0	32·5	371	19	1,285
Melbourne	30·110	29·995	30·629	29·429	56·7	46·7	51·7	62·2	37·4	56·9	43·9	68·1	28·0	132	15	1,357
Sydney	...	30·036	...	...	...	...	...	...	...	60·4	48·2	74·7	38·1	208	6	2,574

* Averages for three years only.

The Observatory, Perth, 11th July, 1905.

W. E. COOKE, Government Astronomer.

RAINFALL for May, 1905 (completed as far as possible), and for June, 1905 (principally from Telegraphic Reports).

Stations.	May. No. of points. 100 = 1in.	May. No. of wet days.	June. No. of points. 100 = 1in.	June. No. of wet days.
East Kimberley:				
Wyndham ...	Nil	...	Nil	...
6-Mile	...	...	...	...
The Stud Station	...	...	...	...
Carlton	Nil	...	...	...
Denham	...	...	...	...
Rosewood Downs	Nil	...	...	...
Argyle Downs ...	...	...	...	...
Lisadell	...	...	...	...
Turkey Creek ...	Nil	...	Nil	...
Ord River ...	...	...	...	...
Alice Downs ...	1	1	...	...
Hall's Creek ...	9	1	Nil	...
Nicholson Plains	...	...	...	...
Flora Valley ...	...	...	...	...
Ruby Plains ...	...	...	...	...
Denison Downs...	...	...	...	...
West Kimberley:				
Obagama ...	Nil	...	...	...
Beagle Bay ...	...	...	...	...
Pt. Torment ...	...	...	...	...
Derby	6	1	62	1
Yeeda	...	...	...	...
Liveringa ...	...	...	...	...
Mt. Anderson ...	...	...	...	...
Leopold Downs...	20	1	...	...
Fitzroy Crossing	1	1	Nil	...
Fitzroy (C. Blythe)	Nil	...	...	...
Quanbun ...	...	...	...	...
Nookanbah ...	...	...	...	...
Broome	118	3	46	1
Roebuck Downs	90	2	...	...
Thangoo	...	...	...	...
La Grange Bay...	196	4	31	2
North-West:				
Wallal	215	5	147	2
Condon	201	6	91	1
Pardoo	232	4	...	...
DeGrey River ...	325	5	...	...
North-West—*cont.*				
Port Hedland ...	374	6	24	2
Boodarie ...	300	5	...	...
Warralong ...	177	4	...	...
Muccan	...	...	...	...
Ettrick	...	...	...	...
Mulgie	209	4	...	...
Eel Creek ...	...	...	...	...
Peake Station ...	159	2	...	...
Coongon	175	5	...	...
Warrawagine ...	...	...	...	...
Bamboo Creek ...	144	4	83	1
Marble Bar ...	207	6	27	2
Warrawoona ...	169	4	...	...
Corunna Downs...	...	...	...	...
Nullagine ...	202	3	45	1
Mt. Edgar ...	...	...	...	...
Kerdiadary ...	...	...	...	...
Roy Hill	...	...	...	...
Middle Creek ...	133	3	...	...
Mosquito Creek...	78	2	...	...
Mulga Downs ...	113	3	...	...
Woodstock ...	...	...	...	...
Mt. Florence ...	97	3	...	...
Tambrey ...	141	4	...	...
Millstream ...	109	3	...	...
Yandyarra ...	...	...	...	...
Mallina	230	2	...	...
Whim Creek ...	269	3	...	...
Cooyapooya ...	312	5	...	...
Woodbrooke ...	318	4	...	...
Croydon	210	3	...	...
Balla Balla ...	...	...	...	...
Roebourne ...	265	5	93	2
Cossack	416	5	111	3
Sherlock ...	317	2	...	...
Fortescue ...	229	5	63	3
Mardie	...	...	...	...
Mt. Stewart ...	...	...	...	...
Yarraloola ...	376	5	...	...
Chinginarra ...	...	...	...	...
Onslow	230	7	9	2
Peedamullah ...	123	5	...	...
Red Hill	...	...	...	...
Mt. Mortimer ...	115	4	...	...
Peake Station ...	96	4	...	...
Wogoola ...	186	6	...	...

RAINFALL—*continued*.

Stations.	May. No. of points. 100 = 1in.	May. No. of wet days.	June. No. of points. 100 = 1in.	June. No. of wet days.
NORTH-WEST—*cont.*				
Nanutarra ...	...	...	...	...
Yanrey	164	5	...	...
Point Cloates ...	...	...	...	...
Edmunds ...	189	7	...	...
GASCOYNE:				
Winning Pool ...	306	7	5	1
Coordalia ...	...	...	...	...
Towara	132	5	...	...
Ullawarra ...	60	1	...	...
Maroonah ...	...	...	...	...
Gifford Creek ...	...	...	...	...
Bangemall ...	...	...	...	...
Mt. Augustus ...	...	...	...	...
Minnie Creek ...	427	10	...	...
Yanyeareddy ...	377	5	...	...
Williambury ...	579	7	...	...
Booloogooroo ...	...	...	...	...
Wandagee ...	545	7	...	...
Bernier Island ...	...	...	...	...
Boolathana ...	373	12	...	...
Carnarvon ...	527	17	101	2
Brick House ...	534	11	...	...
Doorawarrah ...	201	9	...	...
Bintholya ...	...	...	...	...
Mungarrah ...	374	8	...	...
Clifton Downs ...	378	13	...	...
Dairy Creek ...	320	9	...	...
Upper Clifton Downs	387	10	...	..
Dirk Hartog Island	395	14	...	...
Sharks Bay ...	499	11	65	2
Kararang ...	342	13	...	...
Meedo	548	10	...	...
Tamala	465	13	...	...
Wooramel ...	277	9	111	2
Hamelin Pool ...	398	10	81	3
Byro	485	9	...	...
Yarra Yarra ...	454	8	...	...
Berringarra ...	373	11	...	...
Mt. Gould ...	431	9	...	...
Moorarie ...	...	...	...	...
Wandary ...	311	9	...	...
Peak Hill ...	153	7	4	1
Mt. Fraser ...	...	...	...	...
Abbotts	165	6	Nil	...

Stations.	May. No. of points. 100 = 1in.	May. No. of wet days.	June. No. of points. 100 = 1in.	June. No. of wet days.
GASCOYNE—*contd.*				
Belele	374	10	...	...
Mileura	429	13	...	...
Milly Milly ...	372	10	...	...
Manfred ...	496	13	...	...
New Forest ...	371	11	...	...
Woogorong ...	275	11	...	...
Boolardy ...	312	5	...	...
Twin Peaks ...	265	6	...	...
Billabalong ...	305	7	...	...
Wooleane ...	253	7	48	2
Woolgorong ...	357	12	...	...
Murgoo	232	8	43	2
Yallalonga ...	478	12	...	...
Meka	257	7	59	2
Mt. Wittenoom ...	282	10	...	...
Nannine	369	10	Nil	...
Star of the East...	309	7	Nil	...
Annean	401	7	3	1
Coodardy ...	259	8	28	2
Cue	349	12	31	3
Day Dawn ...	386	9	20	3
Lake Austin ...	333	7	41	2
Lennonville ...	385	12	35	3
Mt. Magnet ...	281	13	27	3
Challa	227	12	...	...
Youeragabbie ...	355	8	29	3
Black Range ...	349	11	...	...
Murrum	212	8	37	2
Burnerbinmah ...	208	9	...	...
Barnong	281	13	48	4
Mellenbye ...	242	13	35	6
Yalgoo	225	10	35	3
Wagga Wagga ...	263	13	43	3
Gabyon	283	10	41	3
Tallyrang ...	358	12	...	...
Gullewa	236	11	32	2
Muralgarra ...	259	10	...	...
Wydgee	203	10	...	...
Gullewa House ...	292	10	47	3
Ningham ...	...	...	26	4
SOUTH-WEST DIVISION (NORTHERN PART):				
Murchison House	354	17	160	6
Mt. View ...	168	9	48	4

RAINFALL—*continued.*

Stations.	May. No. of points. 100 = 1in.	May. No. of wet days.	June. No. of points. 100 = 1in.	June. No. of wet days.
South-West (Northern)—*contd.*				
Mumby	433	15	211	9
Yuin	329	11	...	...
Northampton	446	14	311	8
Oakabella	...	...	...	...
Narra Tarra	...	...	...	...
Tibradden	493	16	229	9
Myaree	563	14	206	9
Sand Springs	400	11	251	7
Mullewa	424	12	80	6
Kockatea	445	9	113	5
Bootenal	...	...	...	...
Geraldton	604	16	238	9
White Peak	615	10	...	...
Greenough	485	14	229	9
Bokara	554	17	379	11
Dongara	725	14	434	9
Brookman's Hills	387	15	171	8
Strawberry	555	17	...	...
Nangetty	351	11	...	...
Mingenew	506	16	231	11
Urella	544	13	199	7
Yandenooka	502	15	237	10
Rothesay	209	6	...	...
Condingnow	280	9	...	...
Field's Find	223	9	...	...
Carnamah	442	13	135	8
Watheroo	422	17	220	10
Dandaragan	575	17	328	13
Moora	431	14	250	11
Yatheroo	597	14	...	...
Walebing	510	19	232	12
Round Hill	539	14	182	12
New Norcia	474	15	187	9
Wannamel	672	18	360	10
South-Western Division, Central (Coastal):				
Gingin	793	18	358	10
Belvoir	906	18	385	10
Mundaring	1068	19	542	9
Wandu	847	24	436	14
Guildford	860	22	395	12
Kalbyamba	899	23	439	9
Canning W't'r'w'ks	1124	18	496	9
South-West (Coastal)—*contd.*				
Perth Gardens	848	21	452	10
Perth Observatory	871	23	467	12
Subiaco	840	20	414	12
Claremont	847	19	319	6
Wanneroo	...	...	408	10
Forest Dale	436	19	341	10
Jandakot	994	17	655	8
Fremantle	732	24	283	11
Rottnest	759	21	293	13
Armadale	908	19	594	13
Rockingham	695	17	339	11
Jarrahdale (Norie)	1251	22	582	14
Jarrahdale	1368	22	682	14
Serpentine	1046	21	493	14
Mandurah	1019	19	538	12
Pinjarra (Blythewood)	921	23	451	15
Pinjarra	925	19	522	13
Yarloop	913	22	549	14
Harvey	977	22	604	16
Upper Murray	1092	23	...	...
South-West, Central Part (Inland):				
Hatherley	441	14	...	...
Dowerin	421	15	148	8
Momberkine	368	15	213	8
Monglin	...	...	...	...
Newcastle	608	19	272	9
Emungin	...	...	142	9
Eumalga	648	20	267	11
Northam	406	18	197	9
Grass Valley	354	15	146	8
Meckering	347	17	128	8
Cunderdin	397	15	145	8
Codg-Codgin	308	9	...	...
Yarragin	377	14	...	...
Doongin	233	10	88	5
Cutenning	309	16	102	8
Whitehaven	459	14	183	6
Sunset Hills	417	16	195	8
Cobham	455	18	210	13
Yenelin	466	15	...	...
Mt. Caroline	267	12	140	6

RAINFALL—*continued.*

Stations.	May. No. of points. 100 = 1in.	May. No. of wet days.	June. No. of points. 100 = 1in.	June. No. of wet days.
South-West, Central)—*contd.*				
York	518	20	191	12
Dalebridge ...	469	21	...	...
Beverley ...	671	14	206	8
Bally Bally ...	448	19	223	10
Oakdale	493	21	221	12
Barrington ...	448	16	193	10
Qualin	465	12	...	...
Stock Hill ...	545	15	247	7
Sunning Hill ...	567	9	254	12
Brookton ...	520	16	227	8
Wandering ...	766	16	341	8
Glen Ern ...	664	18	272	11
Pingelly ...	535	15	...	...
Yornan	456	16	220	11
Marradong ...	971	19	377	9
Wardering ...	...	...	220	7
Bannister ...	855	17	363	11
Wonnaminta ...	562	17	..	...
Narrogin ...	599	18	247	10
Narrogin State Farm	603	22	268	10
Wickepin ...	...	...	...	...
Gillimaning ...	514	17	...	...
Bunking ...	332	12	252	6
Bullock Hills ...	352	13	...	...
Bullingarra ...	...	...	...	...
South-West Division (Southern Part):				
Bunbury ...	877	21	521	15
Brunswick ...	1,017	21	554	11
Collie	940	25	531	15
Glen Mervyn ...	1,077	21	567	12
Donnybrook ...	1,134	23	658	13
Boyanup ...	874	24	641	11
Ferndale ...	1,102	21	602	13
Busselton ...	767	20	468	15
Quindalup ...	844	19	560	16
Cape Naturaliste	745	21	409	14
Glen Lossie ...	688	22	...	...
Lower Blackwood	853	18	696	11
Karridale ...	1,280	24	684	20
Cape Leeuwin ...	961	24	659	22
Biddellia ...	814	24	...	...
South-West—(Southern)—*cont.*				
The Warren ...	693	17	634	15
Lake Muir ...	563	18	432	13
The Peninsula ...	840	27	...	...
Mordalup ...	630	18	343	12
Deeside	614	21	441	14
Riverside ...	638	20	497	12
Balbarup ...	328	13	...	...
Wilgarup ...	748	23	574	15
Denningup ...	591	19	432	13
Bridgetown ...	759	22	444	15
Westbourne ...	670	20	...	...
Hilton	689	17	...	...
Greenbushes ...	1,021	18	516	8
Greenfields ...	826	20	461	14
Glenorchy ...	579	17	...	...
Williams ...	641	21	208	10
Arthur	492	17	...	...
Rifle Downs ...	764	13	379	7
Darkan	606	12	...	...
Wagin	440	15	242	11
Glencove ...	348	19	239	15
Dyliabing ...	317	16	192	12
Katanning ...	403	18	375	17
Kojonup ...	752	21	398	16
Broomehill ...	408	16	304	16
Woolaganup ...	...	...	96	12
Sunnyside ...	458	19	359	17
Talbot House ...	530	16	185	9
Woodyarrup ...	337	16	278	14
Mianelup ...	259	18	186	7
Cranbrook ...	338	18	255	11
Toolbrunup ...	248	13	201	11
Tambellup ...	413	18	239	16
Blackwattle ...	...	...	...	...
Woogenellup ...	385	19	...	...
Mt. Barker ...	407	21	253	19
Kendenup ...	440	18	269	12
St. Werburgh's...	339	20	...	...
Forest Hill ...	523	25	301	19
Wilson's Inlet ...	681	15	450	20
Denmark ...	...	...	...	...
Grasmere ...	633	20	456	13
Albany	601	20	429	20
King River ...	443	14	270	10
Point King ...	465	18	499	18
Breaksea ...	581	25	487	23
Cape Riche ...	210	12	...	...
Cherilalup ...	403	15	...	...
Pallinup... ...	368	17	...	...

RAINFALL—*continued.*

Stations.	May. No. of points. 100 = 1in.	May. No. of wet days.	June. No. of points. 100 = 1in.	June. No. of wet days.
South-West—(Southern)—*cont.*				
Bremer Bay ...	259	18	186	14
Peppermint Grove	350	19	237	13
Jarramongup ...	...	...	...	...
Chillinup ...	...	...	...	...
Eastern Division:				
Dural	280	8	7	1
Wiluna	55	4	18	2
Gum Creek ...	217	4	23	2
Mt. Sir Samuel ...	365	6	18	2
Lawlers	300	13	1	1
Leinster G.M. ...	323	11	...	...
Darda	315	8	...	...
Lake Darlôt ...	...	...	...	...
Duketon ...	221	7	49	3
Salt Soak ...	...	...	70	4
Mt. Leonora ...	426	8	12	1
Mt. Malcolm ...	414	8	Nil	...
Mt. Morgans ...	409	8	Nil	...
Burtville ...	...	...	...	...
Laverton ...	462	10	15	1
Murrin Murrin ...	343	7	Nil	...
Yundamindera ...	402	8	9	1
Tampa	327	6	10	1
Kookynie ...	386	7	26	1
Niagara	332	7	60	1
Yerilla	445	10	10	1
Quandinnie ...	317	11	42	3
Edjudina ...	385	11	...	...
Menzies	203	7	30	2
Mulline	251	12	...	...
Waverley ...	240	13	...	...
Goongarrie ...	146	1	54	4
Mulwarrie ...	225	14	45	...
Bardoc	168	6	42	3
Broad Arrow ...	200	9	35	2
Kurnalpi ...	193	9	40	2
Bulong	183	8	25	2
Kanowna ...	160	12	28	4
Kalgoorlie ...	172	14	30	3
Coolgardie ...	163	13	50	4
Burbanks ...	342	12	53	2
Woolubar ...	159	9	34	3
Widgiemooltha ...	180	12	24	3
50-Mile Tank ...	162	8	...	...

Stations.	May. No. of points. 100 = 1in.	May. No. of wet days.	June. No. of points. 100 = 1in.	June. No. of wet days.
Eastern—*contd.*				
Waterdale ...	190	10	...	...
Norseman ...	189	12	21	4
Lake View ...	157	16	...	...
Bulla Bulling ...	215	10	60	3
Boondi	196	11	23	4
Boorabbin ...	209	13	21	3
Koorarawalyee ..	231	14	60	5
Karalee	247	7	45	2
Yellowdine ...	148	8	10	1
Southern Cross ...	185	8	30	2
Parker's Range ...	147	14	...	...
Parker's Road ...	203	10	44	3
Mt. Jackson ...	120	9	...	...
Bodallin ...	187	9	22	3
Burracoppin ...	240	11	...	...
Kellerberrin ...	213	10	137	7
Merredin ...	255	11	97	4
Nangeenan ...	257	9	76	5
Mangowine ...	267	14	...	...
Wattoning ...	...	...	...	...
Noongarin ...	257	9	...	...
Eucla Division:				
Ravensthorpe ...	142	17	136	12
Coconarup ...	139	13	126	13
Hopetoun ...	262	10	155	9
Fanny's Cove ...	229	11	...	...
Park Farm ...	165	10	...	...
Esperance ...	189	15	203	13
Gibson's Soak ...	167	12	...	...
30-Mile Condenser	174	12	...	...
Swan Lagoon ...	117	9	...	...
Grass Patch ...	116	5	...	...
Myrup	218	14	...	...
Lynburn ...	262	14	163	11
Boyatup	...	...	...	...
Middle Island ...	...	...	...	...
Point Malcolm ...	278	17	187	16
Israelite Bay ...	286	20	...	...
Balbinia	206	10	...	...
Frazer Range ...	120	8	...	...
Balladonia ...	137	12	32	2
Southern Hills ...	77	4	...	...
Eyre	217	13	68	10
Mundrabillia ...	...	...	...	...
Eucla	78	11	54	8

The Observatory, Perth,
11th July, 1905.

W. E. COOKE,
Government Astronomer.

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PRINCIPLES OF FARM DRAINAGE.

By the DIRECTOR OF AGRICULTURE.

In many parts of this State there are areas of country in which the maximum fertility of the soil is not being reached on account of the stagnant water which is held in it. Probably the loss occasioned by this in the annual yield of crops would surprise most farmers; but if a thorough understanding of the question was brought home to them they would see that it would pay to drain their land. The soil is good in a great number of instances, and well worth the expense of draining it. Such being the case we will look into a few of the principles of farm drainage, with a view of helping farmers in this most important matter.

To carry off the water from an entire neighbourhood a community of interests are affected, and in this regard it is necessary to form what is known as Drainage Boards to control and provide the capital to construct the main channels designed to carry off the water from all the farms within a given area. The main channels being available the farmer sets to work to make his subsidiary drains. King, in his "Physics of Agriculture," gives some useful lessons in farm drainage, and we cannot do better than act upon the advice he gives, which will be found applicable in the greater number of cases in this country.

The necessity for drainage, in addition to the carrying off of soluble salts which form, by the decay of rock and organic matters, the soil, water requires to be frequently changed or replaced by a fresh supply containing an abundance of atmospheric oxygen, because the roots of plants and microscopic life tend to exhaust this supply. The conditions which demand drainage are those pertaining to flat lands or basins upon which the water from the surrounding higher lands collects; areas adjacent to higher lands where the structure is such as to permit water which sinks into the high land to flow or seep under and up through the low ground, making them

wet; lands inundated regularly by the rise of tides or frequently by the overflow of rivers; extremely flat lands in wide areas which are underlaid near the surface by a thick, close, nearly impervious stratum of clay, such as were formerly old lake bottoms; land like rice-fields, water-meadows, and marshes, where water is applied in excessive quantities at stated times, and must be removed quickly.

"No plant can utilise the resources of the soil to the best advantage unless there is provided for it abundance of root room. In all well-drained soils the roots of most cultivated crops spread themselves widely and to a depth of 2½ to 4 feet or more. When conditions are such as to permit crops to do this the best growth and largest yields result."

Soil better ventilated by Drainage.

King refers to his experiments in regard to the better ventilation of soils by drainage. He says "that the change of air in wet soils, after they have been well-drained, is very much more thorough, and this is perhaps the greatest benefit due to drainage. Lowering the ground water enables both the roots of plants and animals, like earthworms and ants, to penetrate the soil more deeply, leaving passageways larger and freer than existed before. When the deeper clays come dry after being drained, shrinkage checks are formed in great numbers, and through these the air moves more freely. With the deeper penetration of soil air-nitrates are more freely formed, and with the larger amounts of soluble salts the clay is flocculated, making a more granular texture, which again admits the air more freely. When lines of tile are laid under a field 50 to 100 feet apart they furnish an opportunity, with every change in atmospheric pressure and of soil temperature, to force air into and out of the soil; and so a line of tile laid in the soil becomes a system for air circulation. With every heavy rain which causes percolation, where the water can flow away, a volume of fresh air is drawn into the soil after it, completely changing the air.

Kinds of Drains.

"As is generally well known there are two types of drains. Those closed and beneath the surface, after the manner of underground water channels, and open drains, such as ditches, which are in function like natural river channels. The closed forms are the most effective, least in the way, require less expense in maintenance, and are most durable and should generally be adopted, but there are cases where surface ditches must be used.

"In the early history of under-draining, closed drains were made by laying bundles of twigs in the bottom of the ditch and covering them, expecting the water to trickle through the passageway left. In other cases two or three round poles were covered in the bottom of the ditch, or two slabs were laid edge to edge with their round sides down. Two boards were sometimes set on edge, V-shaped, with opening down. More permanent closed drains were made by filling the bottom of the ditch with cobblestones, by setting flat stone on edge and covering with flat stone, and even by using four stones for top, bottom, and sides. In other cases brick was used in place of stone, and some even made tile out of blocks of peat, cutting semi-cylindrical cavities in the faces of square blocks of peat, then laying these together to form the waterway. Most of these devices, however, must be looked upon as makeshifts rather than as permanent improvements; and

although they could, where stone is plentiful, be made use of for the sake of cheapness, they have gone largely out of use. The modern tile, made of hard-burned clay, is cylindrical in shape and usually in 1-foot lengths, with diameters ranging from 2 to 12 or more inches.

Depths at which Drains should be laid.

"The texture of a tile is like that of common brick, and will allow water to flow readily through the walls; but even were the walls watertight, the water could still find access to the tile through the joints formed by the abutting sections as rapidly as it can be brought down by ordinary soils requiring draining. It is seldom necessary to lower the ground water more than four feet below the surface, and except in very springy places, a depth of three feet will answer most purposes. Since the level of the ground water changes with the season, and since many lands which are benefited by drainage are only too wet during the spring, it may be best to lay the drains only so deep as is needful to bring the field into condition for working in due season, and in such cases tile placed $2\frac{1}{2}$ to 3 feet, rather than $3\frac{1}{2}$ to 4 feet, will usually be found sufficient for general farm crops. When tile are placed needlessly deep, not only is the cost greater, but in all of those cases where there is an underflow of water from the higher land, the level of the ground water is drawn down earlier in the season to such a depth that the crop will get less advantage by the sub-irrigation resulting from the capillary rise of the underflowing water into the root zone.

"Generally, drains should be given as much fall as the conditions will permit, and the gradient should not be less than two inches in 100 feet if this can be secured. Cases will occur where less must be accepted and then careful levelling must be done to secure the largest fall available. It will often happen that the line of lowest ground is quite tortuous, making the distance long, and on this account making the fall small. Frequently in such cases cuts across bends can be made by digging deeper, in this way increasing the fall, as is sometimes done by straightening streams. Effort should be made to secure throughout the course of a main or lateral drain an uniform fall, and never, where it can well be avoided, change from a steeper to a less steep grade, because if this is done there is danger that sediment may lodge where the fall is less and close up the drain. The case is different where a change can be made from a small to a greater fall, for then whatever sediment is carried by the water along the flatter slope will be carried down the steeper one."

Size of Tile.

In referring to the proper size of tile, King says "that this can be only definitely stated when the detailed conditions under which the drain is to work are known. They should be large enough to remove in 24 to 48 hours the excess water of the heaviest rains likely to occur. Where single drains are laid here and there in irregular order to drain low places larger tile are required than where a whole area is systematically treated, because in the former case a larger per cent. of surface water from surrounding higher lands will flow upon the low areas under which the drains are laid. The greater the fall the smaller the tile may be. Doubling the grade increases the carrying capacity nearly one-third. The areas of cross-section of tile increase with the squares of their diameters. If their diameters are in the

ratio of 2, 3, 4, 5, 6, 7, their areas will be in ratio 4, 9, 16, 25, 36, 49, but as the friction on the walls of small tile and the disturbance due to eddies set up at the joints are greater in proportion to the amount of water carried, the capacities of tile, running full, increase faster than the square of their inside diameters. It is seldom advisable to use tile smaller than three inches in diameter because so little variation above or below a true grade will fill them with sediment. The size of the main drains must vary with the area they are to drain, with their fall and their length. The data given by Elliott shows that where drains are laid three feet or more deep, and on a grade not less than three inches in 100 feet, a 2-inch main, not more than 500 feet long, will drain two acres.

A 3-inch tile drain will drain	...	5 acres
A 4-inch " " "	...	12 "
A 5-inch " " "	...	20 "
A 6-inch " " "	...	40 "
A 7-inch " " "	...	60 "

"He specifies further that a 2-inch main should not be laid longer than 500 feet and a 3-inch not longer than 1,000 feet.

"Where a sub-main joins a main the connection should be made at an acute angle rather than at a right angle. If this is not done silt will collect on account of the reduced velocity caused by the meeting of the two streams. It is best in such cases to use the manufactured junction tile. The junction of a lateral should, if possible, be made above the axis of the main, cutting a hole through the main with a tile pick. This is to avoid the clogging of the lateral. Where the fall is great enough to admit of doing so one of the best unions with a main is represented in Fig. 1, the end of the lateral being thoroughly plugged with a stone bedded in clay, or, better, with three or four inches of cement. (*See* Fig. 1.)

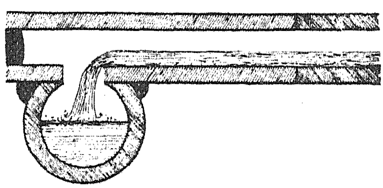


FIG. 1.—Method of connecting lateral with main drain.

"Where, on account of small fall, the lateral must approach the main low down it should be connected in an oblique manner. The demand for water by trees is so great that they must not be permitted to grow within three or four rods of a line of tile which has running water in it during any considerable portion of the season.

"Careful study should be given to the best manner of laying out system of drains, the aim being to secure the greatest fall, the least amount of digging, the least outlay for tile, and the most perfect drainage. To secure these results, drains must be laid so that no two lines are taking the water from the same territory, the outlets must be as few as possible, and only that size tile used which is large enough to do the work."

Surface and Under-drainage.

In many places there are wide stretches of very flat country which can only be drained through surface channels. Such are the districts which in recent geologic times were lake bottoms, over which a heavy sheet of close textured clay was deposited. Soils like these have subsoils so close that, were there plenty of fall and good opportunity to find outlets for drains, the rains could not reach the drains freely enough to meet the needs of crops. Such fields must be ploughed in narrow lands with the dead furrows in the direction of the greatest fall in order to provide a quick removal of the surface rains. Other districts are so flat that the rains have not yet been able to cut sufficiently deep river channels to drain the fields enough for agricultural purposes. The soil may be porous enough, even a coarse sand, and yet for lack of natural drainage channels remain too wet to till. In such cases deep open ditches must be provided to convey the water out of the country, serving as outlets for under-drains laid in the adjoining fields. A district of this type of land drainage is represented in Fig. 2, covering nearly six square miles. (*See* Fig. 2.)

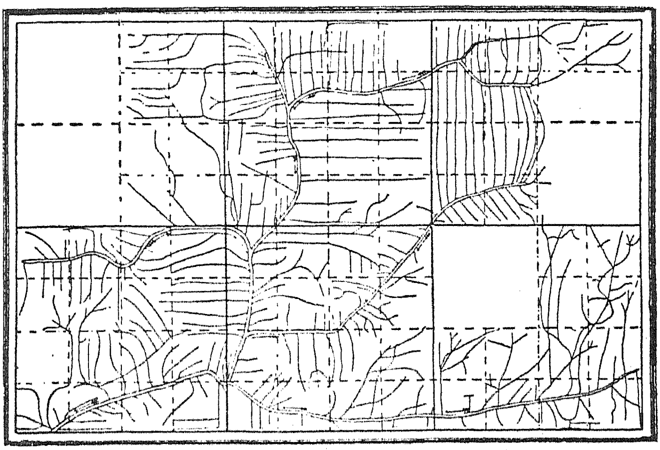


Fig. 2.—Plan for drainage of lands.
The smallest squares represent acres.
Double lines show open ditches.
Single lines are tiled drains.

Professor King gives some sound advice in relation to the practice of under-drainage, and the writer, from personal experience, indorses his remarks. He says that "the best work in under-draining can only be done by the man who has a thorough grasp of the principles of the art and who has had enough practical experience to make him perfectly familar with the essential details, as they vary with soil, climate, topography, and crop conditions. There are many cases of local drainage where the area and expense involved are small, where the farmer having a fair knowledge of the principles of drainage can supervise his own work; but when large areas are to be under-drained, where the fall is small and the surface conditions complex, it will be the safest to entrust the levelling and staking out of the mains and laterals ready for the ditcher to a competent and thoroughly reliable drainage engineer.

"It would be better and perhaps more economical to let the whole job, if it is large and difficult, to a man of experience, who has established a reputation for reliable work. Even in the matter of digging the ditch, and particularly in giving it its finish, as well as placing the tile, drainage engineers find it difficult to find men who have the patience, the feeling of responsibility, and the practical skill to do it well. A man who has the right frame of mind and the skill to do this finishing and most important work well is much more to be trusted than the farmer himself, who has so many duties to distract his attention and tempt him to rush the job. But while the general farmer should not be encouraged to attempt the draining of large and difficult areas on his own place, it is quite important for him to have a clear conception of the general principles of drainage and of what constitutes thoroughly good detail practice.

Determining Levels.

"As a general rule the laying out of a system of drains should only be attempted with good instruments. In determining the differences of level, in different parts of the field it is desired to drain, the simplest method for the inexperienced person is to lay out the field into squares of 100 feet or more, driving short stakes at the corners. Fig. 3 shows method of levelling a field. (*See* Fig. 3.)

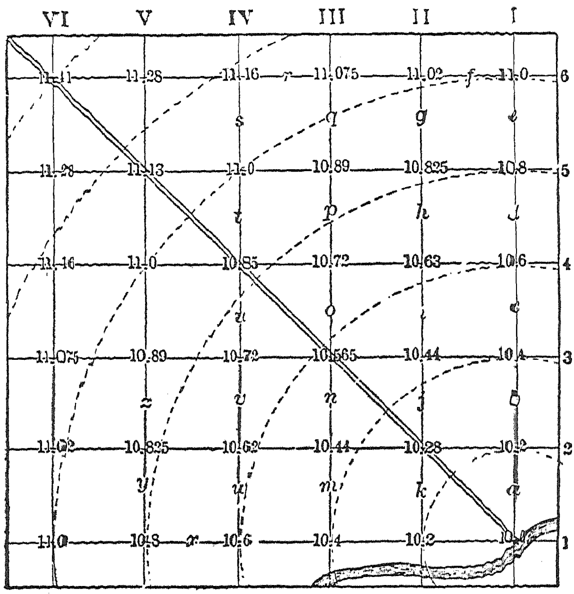


Fig. 3.—Showing method of levelling a field.

"Set the instrument at '*a*,' midway between the stations I–1 and I–2, and record the reading of the target or staff placed on the stake at I–1 in the table in the column headed 'back sight,' which is assumed, for illustration, to be 4 feet. Next turn the instrument upon stake I–2, when its distance below the level is found to be 3·8 feet, and is entered in the column headed 'fore sight.' This shows that the ground at I–2 is 4 feet–3·8 feet=2 feet higher than station I–1.

"In the column headed 'Elevation,' the first station is given arbitrarily a height of 10 feet above an assumed datum plane to avoid minus signs. The level is now transferred to '*b*,' and the distance of I–2 below the instrument found to be 4·2, which is entered in the column 'back sight' as before. Turning now upon I–3 its reading is found to be 4 feet, and this is entered in the column 'fore sight.' The difference in level between the back and fore sight shows the difference in level between the two stations, and is placed in the column headed 'Difference.' The first difference added to the datum, 10, gives 10·2, the height of station I–2 above the datum plane. The second difference, ·2, added to the elevation of station I–2 gives 10·4, the elevation of station I–3 above datum. In this manner the level is moved from station to station until '*e*' is reached, when it is transferred to '*f*' and back sights and fore sights taken as before, and entered in the table to connect the first line of observation with the new one just begun. Proceeding as before the level is moved from '*f*' to '*g*,' and through '*h*,' '*i*,' '*j*,' '*k*,' and '*l*' to '*m*,' and so on, until the field is all completed. When proceeding from higher to lower levels the differences must be subtracted rather than added to obtain the elevation of the lower station.

"When the field has been laid out as represented in Fig. 3, and the elevations of the several stations transferred to the map, the figures show at a glance where the field is high and where it is low. If lines are now drawn upon the map through all places having the same elevation the topography of the field becomes still more evident to the eye. Such lines are called contour lines, and such are the dotted lines in the map.

"It is clear from the contour map that the highest station in the field is VI–6 and the lowest I–1. If then we are seeking the steepest fall or gradient for the main it will be found along a straight line connecting these two stations. Of course no field will be found with so regular a slope as this, but the principle is no less true for being so simply stated. (*See* Fig. 4.)

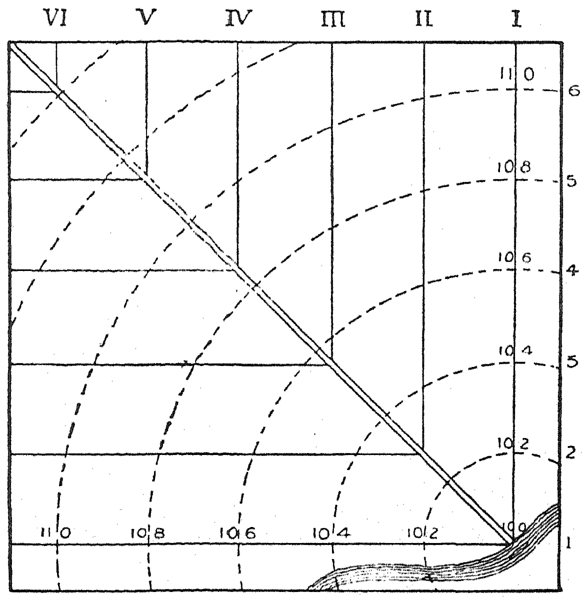


FIG. 4.—Showing a system of tile drains laid out on the levelled field of Fig. 3.

"If such a field is to be drained by placing laterals 100 feet apart, about the maximum fall for them, and the minimum amount of tile and ditching, will be secured by placing the laterals along the lines of levelling, in which case the lines I, II, III, IV, V, VI, will constitute the laterals on one side of the main and the lines 1, 2, 3, 4, 5, 6, the laterals on the other side, as represented in Fig. 4. Since the lines I and 1 are both radii of the same circle and have the same elevation at their outer extremeties, the fall or gradient will be the same, or ·2 of a foot per 100 feet, as shown on the contour map, but along the lines V and 5 the gradient will be ·15 feet per 100 feet, or 1·8 inches instead of 2·4 inches per 100 feet along the lines I and 1. The fall is, therefore, not uniform for all the laterals, nor can it be when they are placed along parallel lines. If the field required drains every 50 feet, then a greater mean fall could be secured and less tile would be required if a system like that of Fig. 5 were adopted. (*See* Fig. 5.)

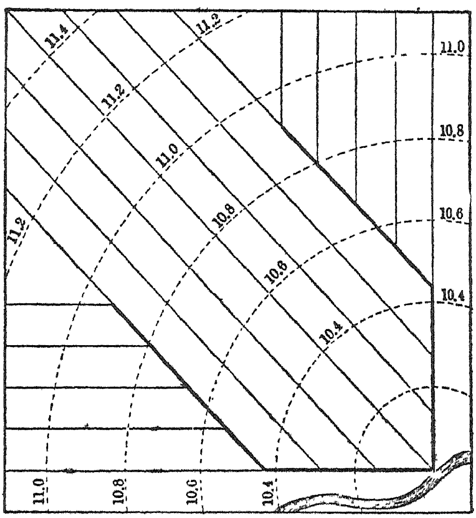


FIG. 5.—Showing a second system of drainage laid on the field of Fig. 3.

"When the positions of the mains and laterals have been decided the next step is to mark them with 'grade-pegs' and 'finders.' The grade-pegs are short, driven securely into the ground, just to one side of the intended ditch, and are placed at regular intervals apart. To one side of the grade-pegs are placed longer ones called 'finders,' upon which is to be recorded the depth below the grade-peg the ditch is to be dug.

"In determining the grade and depth of the ditch the levelling begins at the outlet and the steps are the same as those already described for the field levelling In Fig. 6, which is a profile of the data in the table showing the outlet of the drain at A, the first stake at 0 and the second at 50, etc., up to 600, both the lines of grade and the datum plane are shown. On each numbered stake is given the depth of the ditch below the top of the grade-peg, and below the peg has been set the height of the bottom of the ditch above the datum plane.

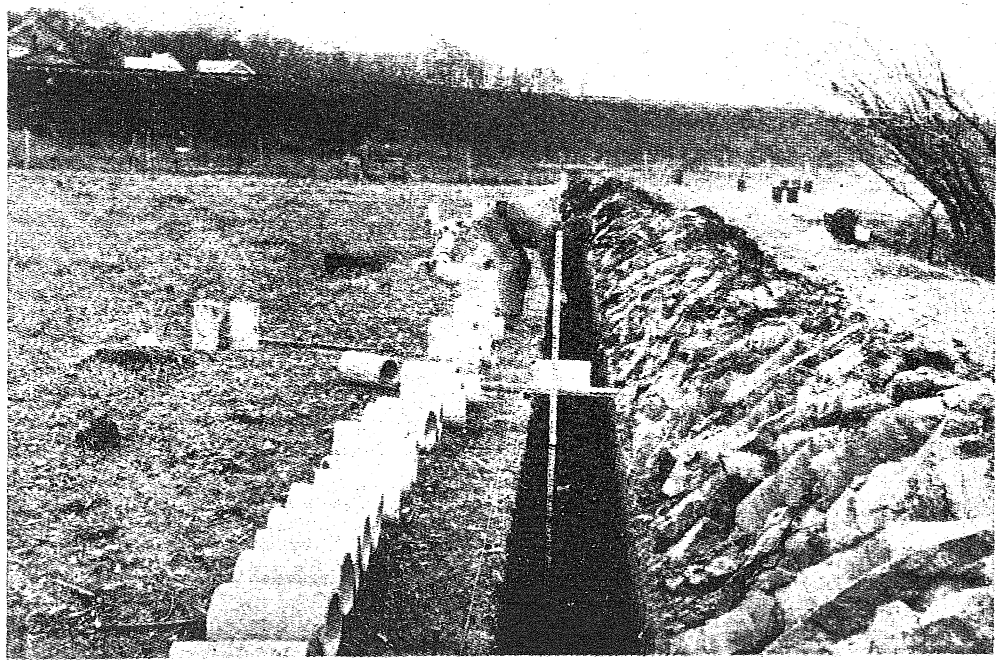


FIG. 7.—Showing method of cleaning the ditch and finishing the bottom with a tile hoe, ready for the tile.

"Since the outlet in this case is seven feet above datum and the surface at 600 feet is 11·36 feet, the total fall is 11·36 feet–7 feet–4·36 feet. But if the depth of the ditch at the upper end is made 2·92 feet the available fall will then be 4·36 feet–2·92 feet–1·44 feet. Since the ditch is 12 times 50 feet long the fall will be $\frac{1.44}{12}$=·12 feet per 50 feet, or ·24 feet per 100 feet. At each 50 feet station then the bottom of the ditch above datum plane will be found by adding ·12 feet to 7 feet, which is the height of the outlet for that of the second station; then ·12 feet added to this gives the third station, and so on thus:—7, 7·12, 7·24, 7·36, 7·48, 7·60, 7·72, 7·84, 7·96, 8·08, 8·20, 8·32, 8·44. (*See* Fig. 6.) If these numbers are subtracted from the heights of the surface of the ground at the respective places the difference will be the depth the ditch must be dug at those places, and the figures are placed upon the finders for the instruction of the men digging. The experienced drainage engineer with accurate telescope level makes the details of levelling, establishing the grade and marking the grade-pegs simpler than here given, but it is not safe for a farmer with a cheap level—such as he would probably improvise with an ordinary carpenter's level—to follow his methods. (*See* Fig. 6.)

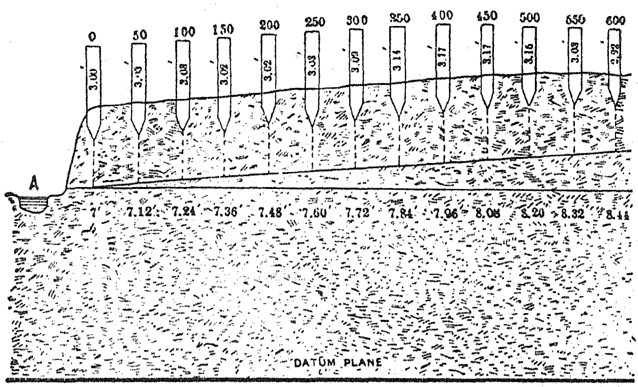


FIG. 6.—Profile of ditch staked ready for digging with depth for the ditch at the several stations.

"To make the ditch straight a strong line is stretched taut near the surface and 4 inches back from the edge. If the ditch is to be only 2½ to 3 feet deep it need be no wider at the top than 1 foot. Where the ditch must be 4·5 to 5 feet and receive a 6-inch tile, as shown in Fig. 7, it must have a width at the top of 15 to 18 inches. (*See* Fig. 7.)

"In Fig. 7 the man in the foreground is using the tile hoe to clean out the last loose earth and to bring the bottom to grade and proper shape to receive the tile. The grade is secured by stretching the ditches' line tight, and on the slant the bottom of the ditch is to be given, and a known height above it. It is then only necessary for the experienced man to use a measuring rod to secure the depth and grade desired.

"When the ditch has been finished the tiles are laid with a tile hook; with the aid of this tool they are placed rapidly and accurately without getting into the ditch. Great care should always be taken to turn and shift

the tile until a perfectly close joint is made all round. It does not do to simply have them meet on the upper edge; they should fit squarely and closely through the entire circumference, and, if necessary, tile too much warped to permit of this, must be discarded. The laying of the tile should begin at the outlet of the main, proceeding upward to the first lateral, where the junction should be made and tile enough laid in the lateral to permit the main to be partly filled. (*See* Fig. 8.) The main may then be carried on until the next lateral is reached, when this should be commenced as before. Care should be exercised not to leave the upper end of an unfinished line of tile open for heavy rains to wash mud into it. If the line cannot be finished before the rain, the end may be guarded by closing it with a board, brick, or bunch of grass."

Enough has here been properly said to convey an idea to the farmer with low-lying wet country of the necessity and method of properly draining his land. Personal instruction will be given to those who are in doubt as to the way to proceed; but a careful study of the foregoing should enable a farmer to succeed.

NOTE.—The blocks illustrating this article are taken from King's "Physics of Agriculture."

NOTES ON FERTILISERS.

By PERCY G. WICKEN.

Last year there was imported into the State 12,770 tons of fertilisers, valued at £43,748. The demand, and, consequently, the imports are increasing year by year. Settlers are finding out that the addition of a fertiliser to their crops means additional profit; and this is the best way to educate people. Convince a man in a practical manner that by investing 10s. per acre in a fertiliser he can turn the 10s. into 20s. by increasing his crop, and this man soon becomes a firm believer in fertilisers. It costs no more for ploughing and working the ground when a fertiliser is applied than it does otherwise—that is, provided the ground is properly worked and prepared for the crop; consequently the additional yield of the crop is due to the addition of the fertiliser, and the percentage of profit on the money invested in the fertiliser can be calculated accordingly.

The farmer, having been persuaded either by reading an article on the subject or by the persuasive tongue of the vendor of some particular brand, decides to give a trial to a fertiliser, and buys a few tons, more or less, generally of "superphosphate," or, as it is commonly known, "phosphates."

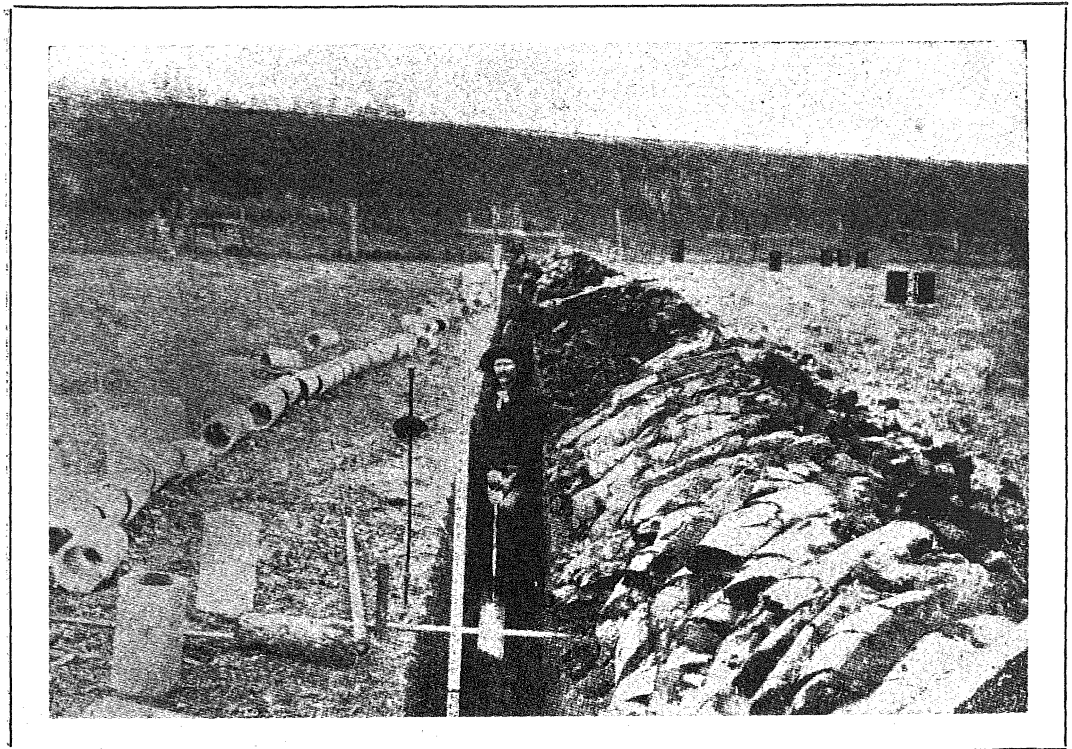


Fig. 8.—Showing four men in line digging a main ditch.

This manure he applies to his crop, the crop responds to the application and a good yield is obtained and the profits go up accordingly. The farmer now thinks he has struck the right thing, and has only to go on with this fertiliser to keep up his yield, so he applies the superphosphate again and again. After a year or two he finds his yields going off and gradually decreasing. He then probably says that the superphosphate is not as good as it used to be, or that the vendor is adulterating the fertiliser, or, again, that some injurious substance is contained in it, or that the soil is exhausted, etc.

We now come to the point at which to take the subject in hand. This fertiliser, "superphosphate," known as "phosphate," contains one ingredient only, viz., "phosphoric acid." It is well known to all those who study agricultural chemistry that all plants require as food four main ingredients, viz., nitrogen, phosphoric acid, potash, lime. The superphosphate applied to the soil supplies the phosphoric acid, consequently, after several applications have been made, the available supplies of nitrogen and potash in the soil become used up, and as the crop cannot grow successfully without the necessary supplies of these foods, the growth becomes stunted, the results unprofitable, and the soil is left in a much worse condition than it was before the application of the superphosphate was commenced. The soil must now be given a rest, and before cropping again must be given a good dressing of a complete fertiliser containing all the three ingredients named. Had this been done in the first place, the fertility of the ground would not have become impaired to such an extent. The length of time during which new land is often cropped with the application of superphosphate only, speaks well for the amount of nitrogen and potash contained in the ground in the first instance, and is also somewhat due to the fact that, owing to the exigencies of the climate, only one crop is obtained a year and the land allowed to lie fallow for a long period, and in some measure recoups itself from the droppings of stock and other natural means of a portion of the ingredients taken from it by the crop. Wheat may be said to be our staple product; 100lbs. of wheat contain :—

	lbs.	
Carbon	44·43	90·29lbs. from air.
Hydrogen	5·54	
Oxygen	40·32	
Soda	0·09	3·74lbs. nearly always present in the soil.
Chlorine	0·03	
Sulphuric Acid	0·31	
Magnesia	0·50	
Oxide of Iron	0·06	
Silica	2·75	
Nitrogen	2·60	5·97 generally deficient in soil and require supplying.
Phosphoric Acid	1·28	
Potash	1·30	
Lime	0·79	

From the above it will be seen that 90·29lbs. of every 100lbs. of the wheat are obtained from the air, 3·74lbs. from ingredients always present in the soil, and 5·79lbs. from ingredients which may be present in the soil but which are generally deficient in a readily available form and which require supplying by means of artificial fertiliser.

Or, to put it in another form, 10,000lbs. of green grass contain :—

	lbs.	
Oxygen	6,667	7,500lbs. water.
Hydrogen	833	
Oxygen	950	2,300lbs. combustible or organic matter.
Hydrogen	130	
Carbon	1,175	
Nitrogen	45	
**Potassium*	41·5	200lbs. ash or inorganic matter.
†*Phosphorus*	4·9	
Calcium	18·1	
Magnesium	5·4	
Iron and Manganese	0·4	
Sodium	7·8	
Sulphur	3·8	
Chlorine	14·5	
Silicon	32·5	
Oxygen, combined with inorganic elements ...	71·0	

The entire weight of the grass contains 76·9 per cent. of oxygen, 9·6 per cent. hydrogen, and 11·8 per cent. carbon, or 98·3 per cent. of the air-derived elements. The elements—carbon, hydrogen, oxygen, and nitrogen being derived either directly or indirectly from the air. The other ten soil-derived elements, together with the nitrogen, form but 1·7 per cent. of the weight of the crop, but it must not be inferred that they are the least important; the air-derived ingredients are generally readily obtainable, while the three essential ingredients are generally deficient. On burning the product the first two groups are given off as gases, while the third group contains what is known as the ash of plants, or the inorganic portion, and which the plant takes from the soil.

The precise position in the plant economy of magnesium, sodium, chlorine, and silicon is not too well known, and many consider their presence in the plants of accidental occurrence. The other ingredients are, however, all necessary, the deficient supply of any one of them is likely to cause a stunted crop. With the exception of nitrogen, phosphoric acid, and potash these other ingredients are generally found in the soil.

An analysis of a typical soil from the Narrogin Experimental Farm was made recently by the Government analyst. The soil taken was a good red loam, on which, previous to clearing, the timber consisted of red gum, white gum, and jam, and is a class of country generally used for wheat-growing in this district. The result of the analysis gave :—

Nitrogen	·119 per cent.
Phosphoric Acid ...	·092 per cent., of which ·0028 is available as plant food.
Potash	·055 per cent., of which ·0113 is available as plant food.

The weight of a cubic foot of dry soil varies from 75lbs. to 105lbs., and after the stones are taken out, the weight of the soil from one acre of ground to a depth of six inches is generally taken, for purposes of calculation, at 2,000,000lbs.

Consequently the above soil contains—

Nitrogen	2,380lbs.
Phosphoric Acid	1,840lbs.
Potash	1,110lbs.

* Equivalent to 50lbs. potash. † Equivalent to 11·3lbs. phosphoric acid.

An ample supply for heavy crops for some years; but, unfortunately, only a very small percentage of this plant food is in a form that the plants can make use of. The result of the analysis informs us that of the 1,840lbs. of phosphoric acid contained in the soil, only 56lbs. is in a form that the plants can make use of. Of the 1,110lbs. of potash only 226lbs. are in an available form.

As mentioned in article on fertilisers in the last issue of the *Journal*, each bushel of wheat requires from the soil 1·5lbs. of nitrogen, ·8lbs. of phosphoric acid, 1·0lb. of potash. Taking an average yield at 12 bushels per acre, we require per acre—nitrogen, 18lbs.; phosphoric acid, 9½lbs.; and potash, 12lbs. We therefore see by this that, according to the above analysis, the soil contains sufficient of these essential ingredients to supply several crops, and would no doubt do so; but practical experience tells us that this land will yield a much better crop, and, consequently, a larger profit to the farmer, if a fertiliser is applied to the soil, as the margin between the amount of phosphoric acid available and the amount required is not sufficiently large. The difference between the amount of phosphoric acid in the soil, viz., 1,840lbs., and the amount available for plants, viz., 56lbs., is so great that the response of the crop to the application of a readily soluble phosphatic fertiliser is easily accounted for. After a time, however, the available supplies of nitrogen and potash become so short that the application of phosphatic fertilisers ceases to have any effect. Phosphates or superphosphate are generally profitable to apply for a first crop, or, possibly, two crops; after that a more complete fertiliser is required. In future issues of the *Journal* I propose to deal with each of the ingredients—nitrogen, phosphoric acid, and potash—under separate headings.

THE ANALYSIS OF SOILS.

By E. A. Mann, Government Analyst.

It is a common fate of scientific methods to be either scorned or else to have too much expected of them; and this particularly applies to the chemical examination of soils. The results of analysis are apt to be either undervalued or over-rated Some contend that the analysis of a soil is of no value whatever in indicating its fertility, while others are disappointed if the agricultural chemist cannot give them such information as will lead to their obtaining maximum crops immediately. The object of this paper is to endeavour to give a clearer idea of the scope and value of soil analysis.

At the outset it must be explained that there are four principal constituents of the soil which are essential to plant life. These are potash, phosphoric acid, nitrogen, and lime. Other substances are necessary, but in smaller quality, and for most purposes it may be assumed that they are present in sufficient quantity in all soils. These four constituents, therefore,

are those with which agricultural chemistry chiefly concerns itself and the percentages of these present are the most important figures in any report of analysis.

The question then arises, when you have made your analysis, what interpretation are you to put upon your figures? How are you to tell whether the soil is good, bad, or indifferent? Different plants require these ingredients in different proportions; for instance, starch-forming plants such as potatoes, require potash particularly, as it assists in the formation of their characteristic constituents, and they must, therefore, have this substance present in the soil in greater quantities than would be necessary for growing grasses. It is evident, therefore, that, strictly speaking, every analysis should be considered with a view to the particular use which is intended to be made of the land, but this is not always possible. A farmer may desire to know what is the best use to which he can put his land, and then the chemist is faced with a rather more difficult problem.

Although different plants require different proportions of the four chief plant foods, it is possible to arrive at certain limits for these constituents which are necessary for any ordinary crop. In other words, it is possible to fix a standard for a generally fertile soil. This standard is to be arrived at as the result of a large number of observations in which the yields of soils have been compared with their composition as given by analysis. Such standards have been adopted and worked by in many countries, and most of them have been more or less of the same character as that used in the Agricultural Laboratory in this State, which is as follows:—

A good soil should contain not less than—

Phosphoric Acid	·15 per cent.
Potash	·2 „
Lime	·4 „
Nitrogen	·25 „

The standard might be too high in some cases or too low in others for particular crops, but is useful as a general guide. In estimating these constituents, the soil is treated with strong acids to extract as far as possible the last traces of the substances even from the refractory compounds which may be present, and the analytical figures are said to represent the "total" potash, phosphoric acid, etc. Now, here is just where the chemical results of analysis have been most attacked.

Instances have occurred in which results thus obtained have not agreed with practical returns. Good crops have been obtained from soils which did not come up to this standard, and, on the other hand, soils which chemical analysis showed to contain ample food plant gave very disappointing results. The consequence is that in many cases chemical analysis came into undeserved disrepute. The explanation of this failure is, however, simple. In the laboratory we extract the "total" constituents from the soil by means of strong acids, but the plant has no such powerful instruments at its command. It is believed that its principal agents in dissolving the mineral substances out of the soil are the comparatively feeble vegetable acids of the fine root hairs, and these are incapable of decomposing the more refractory compounds in the soil so as to abstract their desirable constituents. Only the simpler, more readily decomposed, and more soluble compounds are, so to speak, within the reach of the plants' digestive powers.

In other words, only a small proportion of the total potash (for instance) is available for use by the plant, the remainder being locked up in the inaccessible recesses of the more resistant compounds. We therefore speak now of the "total" and "available" plant food in the soil, and it is recognised by all chemists that the latter is the most important in judging of the fertility of a soil.

A soil low in "total" might be relatively high in "available" and give good crops, hence the apparent inconsistency between results and analysis. In round figures, it may be said that apparently the proportion of "total" to "available" constituents is about ten to one, so that one-tenth of the figures given above would constitute the standard for a good soil judged on this basis. Such a standard, however, cannot be definitely fixed, as will be explained presently. It may at first seem extraordinary that a soil containing such an infinitesimal amount as ·015 per cent. of phosphoric acid should represent a high degree of fertility, but in the aggregate this means a large amount. A depth of soil of one foot over an area of one acre may weigh as much as 4,000,000lbs., and ·015 per cent. would therefore represent 600lbs. per acre of phosphoric acid, equivalent to one and a-half tons of superphosphate. When we consider that a crop yielding 30 bushels of wheat would only remove from such land 23lbs. of phosphoric acid we see that this represents sufficient to supply a heavy crop for 30 years. It must also be remembered that by natural forces of many kinds the refractory compounds of the soil are also gradually being broken down and are continually yielding up further contributions to be added to the available supplies in the soil.

It seems, therefore, that if we could accurately arrive at the amount of available plant food of different kinds in the soil we could rightly appraise its agricultural value. This is the problem at the present time most prominent in the minds of agricultural chemists, and it may be of interest to explain what progress has been made. The first step necessary, of course, is to fix upon a chemical solvent which will accurately simulate the action of the vegetable juices, and is, therefore, comparable with them in its action upon the soil constituents. If we can obtain such a solvent it is an easy matter to extract the soil with it, and by estimating the amounts of fertilising contituents so extracted to get the "available plant food." At present the solvent which is believed to most nearly satisfy the necessary conditions is a one per cent. solution of citric acid, first proposed by Dyer, the English chemist, in 1894. This solvent is now used in many laboratories, and is being applied at the present time to the analysis of our West Australian soils. Experiments made in connection with the famous Rothamstead investigations showed this method gave a very fair indication of the true fertility of the soil.* Chemists generally are not yet altogether satisfied that this solvent is perfect, and an immense amount of investigation is proceeding in America, England, and Germany with a view to obtaining further light on the matter. As showing the importance given to this subject I may give the following quotation from the "Annual Reports on the Progress of Chemistry for 1894," just issued by the Chemical Society in England. "The question of the availability of soil constituents and the best methods of ascertaining this continue to be a prominent one, and in England, Germany, and America alike many investigations have been made."

* These experiments showed that a soil containing ·01 per cent. of available phospheric acid (estimated by one per cent. citric acid) required immediate phosphatic manuring, while a soil containing ·03 per cent. stood in no need of such manuring, the corresponding figures for potash being about ·005 and ·01 per cent.

The Association of Official Agricultural Chemists of the United States, at their forthcoming annual congress will, even more than in past years, be devoting a large part of their time in this matter. So far Dyer's method seems to be the best, but further investigations may show some other method to be preferable. It is only by long experimentation and analysis of soils of known fertility that such a method can be thoroughly tested, and hence nothing final can be arrived at probably this year or in the next five years, but every year we are getting nearer the goal. I might perhaps be allowed to point out the immense assistance which could be afforded by landowners furnishing samples of soil for analysis, together with particulars of crops obtained therefrom, fertilisers applied, etc., and accompanied by samples of the same soil in an uncultivated state. The estimation of the "total constituents," while not of the value at first claimed for it, is nevertheless of great importance, for if by this method fertilising constituents (whether immediately available or otherwise) are shown to be below a certain limit in a soil nothing but manuring can make that soil fertile—and we are able to state definitely in many cases that a soil is of bad quality, but the reverse is not true—we cannot say definitely that a soil is fertile even when containing large amounts of "total constituents." While agricultural chemistry has at least this weapon, it may expect in the near future to be much more efficiently armed with a trustworty means of arriving at the availability of the plant food in the soil, and then great progress may be looked for.

I should like, in conclusion, to give the following indication of how important such a method may be in its application. It has often been a source of astonishment in this State that good returns have been obtained from apparently poor country. Chemical estimations of their total constituents have apparently also pointed to the lands being of poor quality and no explanation of their productiveness has been forthcoming. I have now applied Dyer's method to a number of soils, and the results obtained point to the *possibility* that in these soils we may find an exceptional proportion of "available" constituents and thus their fertility would be explained—I say that this is a *possibility*—the results obtained are two few to justify dogmatism. Considerable work must be done to verify this and to assign a reason. Has the unusual proportion of available constituents been brought about chiefly by climatic or other conditions? We may find here yet another proof that one of Western Australia's richest endowments is her wonderful climate.

NOTICE TO SECRETARIES.—It is requested that secretaries of Horticultural and other societies notify the editor of the *Journal* of the dates fixed for holding of their respective shows in order that they may be published for general information.

THE YALLINGUP AND MARGARET RIVER CAVES.

The beautiful caves of Western Australia, which have recently attracted so much attention, are situated in the South-Western portion of the State, between Cape Naturaliste and the Leeuwin, in an undulating limestone country which skirts the coast-line at a distance varying from half-a-mile to three miles. This cave country, extending as it does from north to south for some 50 miles, is honeycombed with subterranean galleries, displaying marvellous and beautiful geological features which, according to many persons well qualified to express an opinion, are unrivalled for their beauty, picturesqueness, and infinite variety in the Southern Hemisphere, if not, indeed, in the world.

The Trip.

The route at present usually taken from Perth to the Caves is by railway to Busselton, a picturesque little seaport town, forming a quiet and delightful retreat in itself. It is the terminus of the South-Western Railway, and its distance from Perth is 149 miles. The road track from Busselton to the Caves, for the first 15 miles, practically skirts the foreshore on Geographe Bay, making an exceedingly pretty drive, which winds in and out amongst an avenue of luxuriant peppermint trees, the view being relieved occasionally by a glimpse of the sea on the one side and the broad sheets of water of the lagoon on the other. Leaving the Bay, a further five miles travel through picturesque forest country is enjoyably traversed, and the first known cave of importance is reached.

Yallingup Cave.

This cave is so named after the pretty little rivulet which winds round the base of the Wardanup Hill. On the south side of the Wardanup Hill, and about 250 feet above the stream, is the entrance to the cave, which resembles very much a shaft cut through limestone for about 30 feet. Descending the shaft by the easy means of artificial steps, the first chamber met with is one immediately to the right of the landing; it is spacious and dome-like, the ceiling being beautifully ornamented with thickly studded stalactites of a somewhat massive formation; owing, however, to the proximity of this chamber to the main entrance, and the consequent effects produced by the varying atmospheric influences, the stalactites do not present that brilliant lustre and whiteness noticeable in those found in other chambers. On the left of the entrance is a much smaller chamber, profusely decorated with pure white fragile stalactites, forming a marked contrast to the chamber last described. These two, however, serve only as an introduction to the brilliant marvels of the galleries beyond. Proceeding about 100 feet on a slight decline, a series of chambers is explored, each one having its own special individual wonders and curiosities. Nature has here been particularly generous of her handiwork, the most fragile and fantastic stalactites of every conceivable shape and variety adorning the walls and ceiling of every chamber. Massive stalag-

mites, 30 feet and more in circumference, rear their alabaster pillars as if to support the arches high above, their grandeur being rendered all the more pronounced by an intermixture of many objects of the most delicate and fragile beauty. The walls within the "Chamber of Mysteries" are exuberantly decorated with myriads of stalactites of pure white, forming the most lovely and fantastic shapes resembling coral and tracery and carvings of the most cunning workmanship: the graceful folded shawls, semi-transparent with vandyke edges, and variegated by the chemical action of the water, suggest to the enthusiast the idea that each one is trying to surpass the others in its dazzling radiance.

The exploration of the cave takes at least two hours. The principal chambers in it are known as "The Entrance," "The Theatre," "The Foot," "The Crystal Floor," "The Crystal Hand," "The Mushrooms," whilst one of its most notable features is "The King's Jewel Case."

The cave is now brilliantly lit up by electricity, some 500 incandescent lamps being so employed. Picturesque handrails, steps, bridges, etc., have been placed wherever necessary for the convenience of visitors, so that at the present time a visit to this cave is most easy and enjoyable. The guide is always in attendance.

To the visitor to the Caves, travelling from Busselton to Yallingup or the Margaret River, the geological structure of the district, though extremely simple, is not at once apparent, owing to the surface covering of sand and ironstone gravel. On leaving Busselton one passes for some miles over sandy plains, beneath which, at a shallow depth, limestone is revealed in the beds of creeks and swamps. These plains are succeeded, at Dunnsborough on the Yallingup road, and the Lennox River on the Karridale road, by a low range of granitic rocks, masked by a thin coating of sand and ironstone. These in turn give place to limestone as the West coast is approached.

Conclusion.

The caves have been reserved for the use of the public. An excellent road has been made from Busselton to Yallingup. The coast line *en route* is most picturesque, and its numerous little bays abound in fish, so that the angler can enjoy himself to his heart's content. The excursionist will always find something of interest, the district possessing almost every *desideratum* for a perfect holiday. The South-West of Australia will only have to become better known to form one of the greatest tourist resorts in the Southern hemisphere, if not in the whole world. The district not only offers pleasure and delight to sightseers and the hale and hearty, bent on making holiday, but offers a perfect haven of rest and recovery to invalids and convalescents.

Coupons and all further information can be obtained from the Secretary of the Caves Board, 5 South British Chambers, Barrack street, Perth.

LIME AND ITS USES IN VEGETABLE AND ANIMAL LIFE.

By R. E. Weir, M.R.C.V.S.

The natural formation of a large area of our coastal country is of the carbonate, or more commonly known as the limestone composition, from which is derived, after a process of burning, the lime of commerce; but the lighter and more inland parts, as well as the heavier clay lands, are not so favoured in this direction, and in many instances artificial application has to be resorted to to supply the want.

As a plant food lime is, without a doubt, invaluable, and its real worth is its physical effects on the soil. On application it binds the particles forming sandy soil close together, and the more solid surface thus formed prevents undue evaporation and the moisture is retained in the ground. On the other hand, stiff clay lands are made more porous and a free passage is allowed for water and air whereby the soil is made warmer and more easy of cultivation.

Lime also hastens the decay of vegetable matter and sweetens sour lands which may have been more or less submerged. It increases the capillary condition of soil, prevents fungoid diseases, and promotes the growth of more nutritive herbage on pasture land; it also decomposes minerals on the soil containing potash and other food constituents and renders them available for the needs of the plants; further, it decomposes organic matter and promotes the important process which is so much in evidence at present, viz., nitrification.

Thus, to sum up, lime may be said to have a mechanical, chemical, and biological action, and the importance of a systematic application of this invaluable fertiliser to lands which are at present in lack of it should be apparent to all agriculturists. When this need is supplied, many of the ailments from which stock suffer from lack of this very necessary substance in plant food will be avoided. Acidity of the stomach, so frequently met with amongst cattle that will be noticed standing in a paddock chewing bones for hours at a time, is attributable to want of alkaline matter in the food supply; malformations at birth, particularly with foals and lambs, can also be traced to the same cause. The anemic condition, often noticeable amongst cattle which have depastured for any lengthened period on light country, has the same cause of origin.

NOTES ON THE CHAPMAN EXPERIMENTAL FARM.

JULY, 1905.

By R. C. Baird.

This month (July) has seen the last of the cereal cropping for the year. The weather proved favourable for drilling, and the soil was in nice condition for receiving the grain. We finished sowing operations on the 17th, and had it not been for a breakage of the drill gear—which necessitated sending to Perth for a new part, we would have finished one week earlier. We have succeeded in getting all the grain in under favourable conditions. The growth of the earlier sown crops has been well maintained during the winter months, and with the advent of warmer weather they will grow more rapidly.

The 50 acres of rape is making good growth and will be most useful to us for fodder.

Ploughing and subsoiling for the new orchard has been completed, and the ornamental trees have been planted around the buildings. We are now engaged planting the new orchard, which will contain about 240 fruit trees. A piece of land directly in front of the house has been subsoiled for vines. This piece of land has a nice slope, and is better suited for vines than fruit trees. About 1,000 vines will be planted.

In subsoiling for the orchard and vineyard the single furrow Oliver plough was used, turning the sod to a depth of 7 inches, followed by a heavy dam-sinking plough drawn by four horses and going to a further depth of 7 inches, thus making the total depth 14 inches. The heavy plough was used without the mould-board so as to thoroughly break up the subsoil without bringing it to the surface.

Several varieties of peas have been sown during the month and are now showing above ground.

The last planting of potatoes for the season has been carried out. The varieties planted are "Northern Star," "Factor," "Evergood," "King Edward VII." The early sown potatoes, which were well above ground and looking well six weeks ago, have lately been nipped by frost.

The crossbred ewes have now finished lambing; 84 per cent. of lambs have been marked. The ewes are in fair condition and the lambs are strong and healthy. I expect to put them on the rape crop in the course of a week or two, weather permitting.

The Shrop. ewes have not yet finished lambing. As a number of these ewes were only two-tooths when put to the ram I do not expect a very high percentage of lambs from them.

The cattle grazing on the natural pastures are holding their condition, while the milch cows are getting a little extra feed in yard morning and night.

The horses are all in good condition. Seven of the brood mares, are, I think, in foal. A number of inquiries have been received regarding the

stallion's fees, etc., for the coming season. I expect to have a large number of mares booked for the season.

Satisfactory sales of pigs, turkeys, and angora bucks continue to be made.

The fowls are now laying fairly well, and the incubator has been started.

Fencing is being proceeded with in No. 5 paddock and will be completed shortly. Fencing the new orchard and vineyard is also being carried out.

For the next month the principal work will be the ploughing and preparing land for summer fodders, the completion of the fencing around the orchard, and the clearing of some land in the house paddock.

GRAIN-EATING BEETLE.

The Agent General writes from London, under date 6th July, forwarding a copy of a report from the entomological adviser to the Board of Agriculture in London regarding specimens of insects found in some samples of wheat forwarded from this State to London. The report states:—

"The insects are *Calendra granaria*, a beetle which, with its close ally *Calendra orynæ*, is very troublesome to stored grain, and to cargoes of grain in ships. Wheat, barley oats, and Indian corn may be attacked, and *C. orynæ* also attacks rice.

"The females lay their eggs—one egg to a grain—(there may be more than one in Indian corn), and the larva on hatching feeds on the contents of the grain. The length of time from egg-laying to the issue from the grain of the new brood of beetles varies much with the conditions. At a temperature of 80° F., and with other conditions favourable, the whole life-cycle can be completed in about a month.

"How to rid the Grain of the Pest.

"1. By sieving or screening. The infected grain is run through a sieve or down a screen whose mesh-work is such that the grain is kept back, but the beetles run through to be caught in a vessel arranged below for the purpose—the vessel to contain paraffin.

"2. Fumigation.—This is the best measure, the fumigating being done by bisulphide of carbon. This liquid volatilises readily, and the vapour, being heavier than air, sinks. To use the bisulphide of carbon: place the grain to be treated in a bin or air-tight receptacle. Pour into a saucer or shallow vessel some bisulphide of carbon, and then lay the saucer on the top of the grain. Leave for 24 hours after closing the receptacle holding the grain. The fumes will sink through the grain and kill all the insects. 2lbs. of bisulphide of carbon will do to fumigate one ton of grain. In disinfecting a store or mill 1lb. bisulphide of carbon is sufficient for every 1,000 cubic feet of space. Before entering the mill after such fumigation

the doors and windows should be thrown open for an hour or two in order that the place be well ventilated.

"The fumes must not be breathed by the operator, nor should a naked light be brought near them."

KATANNING AGRICULTURAL AREA.

The following report has been forwarded by Mr. John A. Hall, of the Lands Department, to the Under Secretary for Lands :—

In accordance with instructions, I beg to forward this report dealing with the improvements effected in the Katanning Agricultural Area.

The Katanning area embraces 50,617 acres, of which about 40,000 acres have been selected.

The land is a stiff chocolate loam and is undulating in character, being timbered with Jam, White, York, and Salmon Gums.

Water is obtainable at a shallow depth almost throughout the area, and this explains the comparatively small outlay in water conservation as shown below.

Wheat-growing is the principal pursuit; most of the farmers have a few sheep, while some of them have a considerable number, but this part of the country is still very much understocked.

Splendid improvements have been effected, there being no less than 207 miles of stock-proof fencing (*i.e.*, six wires, seven wires, and three wires and netting), also about 70 miles of three-wire fencing.

There is a large area under cultivation, 12,600 acres being cleared, while 11,900 acres have been under cultivation, and 11,270 acres are ringbarked.

Many of the settlers have planted small orchards, there being a total area of 54 acres planted with fruit trees in this district.

There are a good many freehold blocks in this area. and most of the best houses and farm buildings are situated on them, so they do not show in this report.

The moneys expended in various improvements are as follows:— Dwellings, £3,200; farm buildings, £1,100; fencing, £7,700; clearing, £12,600; cultivation £5,980; water conservation, £1,200; ringbarking, £700; and gardens, £810, making a grand total of £33,340, or at the rate of 16s. 6d. per acre selected.

There are some fine properties in the area, those of Messrs. Wanke, P. and J. Cunneen, E. Quartermaine, L. S. Bell, and F. Quartermaine showing out amongst others.

I noticed while going amongst the farms that no provision seemed to be made for saving fencing posts and building material while they were clearing the land. Everything was burnt, and in a very few years jam posts will be as scarce in this locality as they now are in some of the older settled portions of the State.

NOTES ON THE EXPERIMENTAL FARM, NARROGIN.

By Frank L. Faulkner.

To the Director of Agriculture.

I beg herewith to submit my report on the farm for the month of July, 1905:—

The early part of the past month was very wet, five inches of rain being recorded up to the 10th of the month. The total reading for the month was 4·11 inches, the latter part being rather fine and dry. The lowest temperature recorded was 28·5°, and only six mild frosts were registered. Notwithstanding the fine warm spell, crops in the district and on this farm have made very slow headway; the only ones that have grown well being those on strong red warm soil. A portion of the farm crop that was sown earliest is doing very well.

During the month about 30 pigs, the milking cows, and 20 ewes and lambs have had the advantage of feeding on the rape and are all doing well. The rape is making a little headway now, and is, if anything, getting better feed every day.

During the month six Aexter heifers arrived from Mr. Rose, at Bunbury. The heifers are in good condition and have been put in the best paddock of feed on the farm.

On the 25th July 133 lambs were tailed. This is not quite the total lambing, and by the time all are tailed I expect an average of close on 80 per cent. This percentage includes all the ewes on the farm (excepting the Shropshires), about one-third being maiden ewes.

With the Shropshires we have been unfortunate.

During the month we have been kept busy tending the orchard, sowing and preparing for grasses, peas, lucerne, and preparing for and planting trees, hedges, and plantations around the buildings and homestead.

Sixty cherry trees (10 varieties) have been received and planted.

The stock on the farm are all in good healthy condition, the lambing ewes being the least vigorous.

The country is everywhere still very wet, and, excepting on the ridges, will not carry a horse or an implement.

We have now seven students on the farm, and I am pleased to say they are all doing very well.

JULY NOTES ON STATE FARM, HAMEL.

By G. F. BERTHOUD.

WEATHER.—The early part of July was very rough and wintry. Heavy rains fell, followed by high winds. The brooks overflowed over the low-lying lands, but without doing much damage to the crops. Remaining part of the month was fair, with a few slight frosts.

WORK.—Field work this month was somewhat unpleasant owing to rough weather. The drains are acting well by taking off surplus water from the orchard and other blocks. On wet days shelling and grading seed maize was attended to. The last week of July was devoted to planting out the fig orchard, also ornamental and other trees, for shelter around the homestead, poultry and pig yards.

CROPS.—The experimental plots of cereals and grasses are making good progress. The young plants have a deep healthy colour, and are not damaged by excess of wet like last year. So far this season is a very favourable one for agriculture in this district, where the winters are usually too wet.

FIG PLANTATION.—Area, six acres; soil, low-lying, red loam, of fair quality, drained by surface channels. The trees are planted about twenty-three feet apart every way. Varieties compose those lately introduced from California, viz., Smyrna and Wild Capri, Nos. 1 and 2, also other choice sorts. Judging from the fine progress made by the figs planted last year on similar soil, they should thrive well, and form an interesting feature on this farm.

SEED RICE.—The varieties "Bertone" and "Yamani" gave the best results here last summer. Seed of these two is now available in free trial packages to farmers who have suitable moist summer land. The seed should be sown thinly, in drills about 18 inches apart. Fertilisers: Bone-dust, or complete manure, at the rate of 3cwts. per acre in the drills; cover one inch deep. Sow during September and October.

POTATOES.

New Imported Varieties.—Those named below are some of the latest introductions from noted growers in England and Scotland. They arrived here too late to obtain reliable results. Owing to late planting and heavy rains we had during the early part of this winter, followed by high gales and cold weather early in July—all combined—broke up the plants badly. They were taken up too soon. Although the tubers are rather small and not fully matured, they are nice, clean, sound seed. This, when planted in the summer months, should give good returns. This trial planting, even if not entirely satisfactory, is useful to show which of these new kinds are likely to prove suitable for profitable culture in this State.

"Queen of the Veldt," "Dalmeny Red," "Duchess of Norfolk," "Vermont Gold Coin,"

are strong, healthy growers, producing fine-shaped, even sized tubers, very promising and likely to prove desirable acquisitions.

The new American kinds:—

"Noroton Beauty," "Harris' Snowball."

were planted later, and are looking well.

These potatoes were grown on the high land plots, which have been under cultivation for several years. Soil consists of a light loam of fair quality.

Manure, complete fertiliser, applied when planting, at the rate of 6cwts. per acre. Rows three feet apart; small cut sets planted every two feet along the row, covered four inches deep. Plants sprayed five times at intervals, with bluestone and lime mixture, as a prevention against fungoid leaf disease.

"*Duchess of Norfolk*" (Daniels).—English seed. Planted 20th April; germination even and quick; growth vigorous and healthy; foliage broad and smooth; taken up 31st July; tubers of nice even size, set close to stalk; shape round and slightly flattened; colour yellowish white; eyes shallow. Promising table variety.

"*Eldorado.*"—In England and elsewhere great interest was taken in this sensational potato last season, phenomenal prices being paid for single tubers. Originated with Findlay, a celebrated Scotch raiser of new varieties. The seed was imported from England and Scotland. Planted 20th April; germination slow and weak; growth poor and sickly. Yield light; tubers small; shape oblong; skin white, with shallow eyes. So far results obtained here are very disappointing.

"*Dalmeny Radium.*"—This new potato was raised on Lord Rosebery's farm. Planted 20th April; germination quick; growth healthy and good; taken up 31st July. Yield fair; tubers medium size, oblong or pebble shape; skin white; eyes shallow; said to be a splendid cooker. Second early and productive.

"*Queen of the Veldt.*"—Scotch seed. Planted 20th April; germination even and good; growth free and healthy; taken up 31st July. Yield good; tubers of nice size, long or kidney shaped; colour a beautiful purple; shallow eyes; prolific cropper. Main crop variety.

"*Dalmeny Red.*"—Scotch seed. New variety; raised on Lord Rosebery's farm; planted 20th April; germination good; growth fairly robust; taken up 31st July. Yield fair; tubers of neat, even size, round; colour pink; shallow eyes. Promising main crop variety.

"*Vermont Gold Coin.*"—American variety. Planted 20th April; germination even; growth hardy and vigorous; taken up 31st July. Yield good; tubers set close to stalk; nice even medium size; shape round to oblong; skin white, slightly rough; eyes shallow; productive. Second early variety, promising.

"*Moneymaker.*"—Seed from Scotland. Planted 20th April; germination quick and robust; growth healthy; taken up 31st July. Yield good; tubers very numerous but rather small; not fully matured; skin very white and glossy; eyes shallow; shape oblong. Late and prolific variety.

"*Pink Blossom.*"—Seed from Scotland. Planted 20th April; germination good; growth moderate and fairly healthy; taken up 31st July. Yield good; tubers of fair even size; oblong shape; skin white; eyes shallow. Promising main crop variety.

Maize.

This valuable summer cereal is said to be a native of Central Mexico, where the plant is found in its wild state. It is extensively cultivated throughout the American continent and in other suitable parts of the world. The plant is a strong grower, the chief essentials of success are a warm, moist climate, and rich soil.

The lowlands on this farm are light and peaty; a stronger soil would give better results by filling out the cobs properly. This applies especially to the late varieties. These, owing to their luxuriant growth, require a soil naturally rich, or one made so by liberal manuring, to attain perfect development and yield profitable returns of grain. The Flint varieties are more dwarf and mature earlier, therefore better adapted for culture on lands of moderate quality.

Sowing.—Here, on low, moist soil, the best time for planting is during September, October, and November; when sown later the grain often fails to mature properly before the autumn rains sets in, which damages the crop. When growing for seed, I usually sow in drills four feet apart, allowing the plant to stand from 18 inches to three feet along the rows according to the variety. May also be sown in hills three to four feet apart each way, with good results.

Manuring.—I always use a complete fertiliser composed as under:—

4 parts soluble superphosphate
1 part sulphate of ammonia
1 part sulphate of potash.

All lumps in abovenamed fertilisers should be broked up fine, then sifted, and mixed well together before using. Apply thinly along the drills at the rate of 4 to 6 cwts. per acre, or below the surface in the hills where the seed is to be sown. To obtain the best results the fertiliser should be well mixed with the soil a few inches below the surface.

The 21 varieties named below were grown here in trial plots last summer. Most of the American seed arrived too late to give them a fair trial. However, taken as a whole, the results are fairly satisfactory. The yields are computed from the weight of clean grain produced on an average drill, one chain in length, from each plot, and may be taken as reliable in showing the productiveness of each sort on this class of soil.

Seed for distribution, carefully selected from the best varieties grown here, is now available for sending out, in free trial packages, to all agriculturists who may desire to try this cereal. All applications should be sent in soon. The maize plant, when several kinds are grown close together and flower at the same time, will cross-fertilise easily; therefore some of the seed may produce plants not true to the type.

"*Funk's Ninety-Day.*"—Imported American seed; good even sample. Sown 3rd October; germination slow and uneven owing to heavy rains and cold weather setting in after sowing; dwarf habit; growth weak; height to four feet; matured one ear per plant; set low down on the stalk; ripe last week in March. Yield light, rate of 15 bushels per acre. Ear medium size,

six inches in length; kernels in 14 rows; core red, small. Grain dented, bright yellow. May be a useful variety when grown under more favourable conditions. Second early variety.

"*Funk's Golden Eagle.*"—American seed, fine even sample. Sown 5th October; germination very slow and uneven; owing to cold wet weather about half failed to come up; growth weak; height to four feet; matured only one cob per plant; ripe last week in March; ears of fair size, eight inches long, well filled; kernels closely set in 14 rows; core pink, of medium size; grain large bright yellow and dented. Yield light, rate of 22½ bushels per acre. Second early variety.

"*Funk's Yellow Dent.*"—American seed of good even sample. Sown 27th September; growth not tall but strong, stands up well; height to six feet, level and even; one to two cobs per stalk; ripe early in March; ears to nine inches long, well filled at the butts and tips; kernels sets closely in 16 rows; core deep red and slim; nice deep grain; colour bright yellow. Yield good, rate of 45¼ bushels per acre. Good early variety.

"*Holt's Strawberry.*"—American seed. Sown 29th September; growth very vigorous and healthy; foliage wide; stalks strong; stands up well; height to nine feet; cobs large and long, one to two per stalk; ripe late—first week in April; ears well filled, with soft large kernels; set in 14 rows. The grain is very distinct in colour—white-striped and flushed bright strawberry red; core pink. Yield good, at the rate of 58 bushels per acre. This variety requires a warm climate and rich soil to mature properly.

"*White Dawn.*"—Local seed. Sown 7th November; growth very even and healthy; foliage wide; stalks strong; stands up fairly well; height eight feet; level and neat; one to two cobs per stalk; ripe early in March; ears to nine inches long, well filled with white dented grain; set in 14 rows; core white; medium size. Yield fair, rate of 37½ bushels per acre. Good second early white for culture on moist lowlands and river flats.

"*Austin's Colossal.*"—Local seed. Sown 3rd November; growth healthy and vigorous; stalks strong; stands up well; height eight feet; level and even; cobs large, one to two per stalk, rather badly filled owing to soil being too light and peaty on this plot; ripe second week in April; ears to 12 inches long; grain deep set in 16 rows; colour deep yellow dented; core white; prolific main crop variety, but should be grown on strong land. Yield good, at the rate of 57 bushels per acre.

"*Abercrombie.*"—Local seed. Sown 24th November; growth very healthy, tall and even; height nine feet; stalks slim but strong; stands up well, bearing one to two cobs of fair size and well filled; ripe end of April; the stems remain green and sappy for some time after the cobs are fully ripe; ears nine inches long; deep grain set in 12 rows; colour bright yellow and dented; core white and red. Yield good, at the rate of 54 bushels per acre. Main crop variety.

"*Old Gold.*"—American seed. Sown 1st December; germination slow; some seeds failed to come up; growth moderate but healthy; height four to six feet; stands up fairly well; producing one good cob per stalk; ripe middle of April; ears seven inches long; thick set and well filled; kernels in 16 rows of fair size dented; of a bright yellow; core red, medium size. Yield good, at the rate of 52½ bushels per acre. Main crop variety.

"*White Cap.*"—American seed. Sown 2nd December; growth good and even; height six feet; stands up well; one to two good cobs per stalk;

ripe second week in April; ears seven to eight inches long; grain closely set in 16 rows; kernels of fair size; colour pale yellow, tipped with creamy white; core pink; medium size. Yield fair, at the rate of 36 bushels per acre. Second early variety.

"*Old's Mammoth Flint.*"—American seed. Sown 8th December; germination and growth good, level, and neat; height to six feet; stalks slender; stand up well, and producing one cob to each; ripe third week in April; ears to 11 inches long; kernels large, smooth and glossy; colour blood red flushed with yellow; set in eight rows; very handsome and distinct. Yield fair, rate of 30 bushels per acre. Good flint variety.

"*Old's Reliance.*"—American seed. Sown 1st December; germination fair, a few seeds failed; growth not very strong owing to plot drying out early; stalks slender but strong; stands up well; height five to six feet; ripe middle April. Grain yellow-dented, of good quality. Yield light, at the rate of 28 bushels per acre. Appears to be a good sort when grown under more favorable conditions.

"*Iowa Silver Mine.*"—American seed. Germination fairly good, a few seeds failed; growth strong and vigorous; fine wide foliage; stalks produce one to two cobs; stands up well; height, eight feet; level and even; ripe late, end of April; ears to nine inches in length; tips badly filled; grain in 18 rows; kernels white, deep and dented; core white, large. Yield rate of 36 bushels per acre. Late variety, requires warm climate and strong rich land to mature properly.

"*Pride of the North.*"—American seed. Sown 9th December; germination even; growth vigorous; stalks medium size; stands up well; height six feet, level and neat; produces one to two cobs per stalk; ripe middle of April; ears eight inches long; grain in 14 rows, bright yellow and dented, core red. Yield, at the rate of 33 bushels per acre. Fair, second early variety.

"*Riley's Favourite.*"—American seed. Sown 9th December; germination even; growth good; stalks strong; stands up nicely; foliage wide; height seven feet; producing one to two cobs per stalk; ripe late, end of April. Yield, at the rate of 46 bushels per acre. Ears, eight inches, long, thick, and well filled in 14 rows; kernels large, deep yellow dented; core white. Good main crop variety.

"*Reid's Yellow Dent.*"—American seed. Sown 9th December; germination very even; growth tall and vigorous; heavy foliage; stalks strong; stands up well; height eight to nine feet; two cobs per stalk; ripe end of April; seed mixed, not true to type; ears eight inches in length; grain in 16 rows, well filled; kernels of fair size, bright yellow and dented; core red. Yield good, rate of 46½ bushels per acre. Main crop variety.

"*Boone County White.*"—American seed. Sown 13th December; germination bad, partial failure; growth vigorous; foliage wide; stalks strong; stands up well; height six to seven feet; ripe end of April; one cob per stalk; ears to 10 inches long; grain in 16 rows; kernels large, pure white, and dented. Yield at the rate of 34 bushels per acre. Late variety, suitable for warm climate.

"*Hickory King.*"—American seed. Sown 13th December; germination and growth good; wide, ample foliage; stalks medium size; stands up well; cobs are well filled at butts and tips; ripe last week in April; ears to nine inches in length; kernels wide and deep; pure white, dented; very hand-

some and of good quality; core white and very small. Yield, 34 bushels per acre. Good main crop variety.

"*Sander's Improved.*"—American seed. Sown 13th December; germination and growth very vigorous; foliage wide and thick; plant stools out well; would be useful for ensilage; height 10 feet; stands up well; ripe late, end of April; ears eight inches in length; grain in 14 rows; butts and tips well filled; kernels white and glossy—dented; core white. Yield, $38\frac{1}{2}$ bushels per acre. Late variety, suitable for warm climates.

"*Virginia Ensilage.*"—American seed. Sown 13th December; germination and growth good; wide, heavy foliage; stalks tall and strong; stands up well; does not stool out much; height 10 feet; two cobs per stalk; ripe late, end of April; ears seven to nine inches in length, well filled; 14 rows; grain white and dented; core white. Yield good, 45 bushels per acre. Late variety, requires warm climate to mature properly.

"*Eureka.*"—American seed. Sown 13th December; germination and growth good; stalks strong; stands up firmly; nice wide foliage; very tall and firm; height 10 to 11 feet; produces two cobs per stalk; ripe end of April; cobs six to eight inches in length; grain set in 12 rows; kernels flinty, glossy white; core white, large. Yield at the rate of 36 bushels per acre. Late variety, suitable for ensilage.

"*Mosby's Prolific.*"—American seed. Sown 13th December; germination and growth good; stalks strong; stands up well; height eight feet; ripe late in April; cobs to nine inches long, thick and heavy; grain set in 18 rows; kernels deep white dented; core white, large. Yield at the rate of 40 bushels per acre. Late variety.

HAMEL STATE FARM.

ANNUAL REPORT 1904-5.

By G. F. Berthoud.

I have the honour to submit a brief summary of work done here for the past year ending 30th June, 1905.

Visitors.

The farm adjoins Hamel Siding on the South-Western Railway, about 70 miles South of Perth and 40 North of Bunbury. The plots are at their best from October to Christmas and March and April. During the past season many agriculturists and others have called to inspect the various plants, etc. Visitors are always welcome, and a furnished room is set apart for their accommodation.

Buildings

consist of a W.B. dwelling house containing five rooms. The outbuildings are one two-stall stable and feed room, one shed and tool room, two poultry houses, four pigsties. All are constructed of jarrah timber roofed with galvanised iron.

Staff.

Geo. F. Berthoud, experimentalist; W. C. Crawford, ploughman; B. Fitz-Patrick, general assistant.

Work.

The general objects of the work carried out here are purely experimental, chiefly for testing new varieties of fruits, tubers, grains, and grasses. Flowers and ornamental plants are not cultivated on the farm. Full reports on the results obtained from the various crops are embodied in the monthly notes published in the *Journal of Agriculture.*

Season.

The rainfall during the winter and spring months was very heavy. We have no rain gauge, but I think the fall exceeded 50 inches. The brook overflowed its banks seven times, covering all low lying lands, doing serious damage to the cereal and other crops. Owing to this cause the yields of grain are much below the average of former seasons. The brook has since been deepened, and surface channels opened, which has greatly benefited the place. We had very little rain during the summer, which was a mild one, favourable to the growth of maize and other summer crops.

Area.

The farm contains a total of 78 acres, allotted as under:—Homestead, 21 acres, all low land; part of this is laid down in permanent pasture, the balance along the edge of Samson's Brook is devoted to experimental plots of maize, rice, potatoes, hops, and other summer plants. The other blocks are situated on James' Road, about one mile from the homestead; these comprise blocks 7 and 8 (area 10 acres) on which is planted the orchard (four acres) and fig plantation (six acres). Block 10 (area 10 acres) has been cleared and securely fenced; it will be fallowed and sown down with permanent grasses.

Block 11 (area 22 acres) was lately cleared and fenced. A portion of this is ploughed and sown with experimental plots of cereals and grasses; the balance is now being fallowed.

Blocks 12, 13, 14 (area 15 acres), adjoining the orchard, have been lately added to the farm. These are now partly cleared, but not yet fenced in. The soil on the above allotments consists of a fair low land loam of moderate depth.

Implements.

Our plant consists of:—

2 single furrow ploughs.	1 farm dray.
1 set iron harrows.	1 winnower.
1 orchard spading harrow.	1 corn sheller.
1 Planet cultivator.	

Prison Labour.

The fences—boundary and divisional—are all well built of substantial posts, wire, and netting. The jarrah posts were split, and the fencing and gates erected by the prisoners. All the out-buildings, pig and poultry yards, etc., were erected, some of the larger drains were opened, also most of the heavy clearing on this farm was done by prison labour.

Draining.

Although low and flat, most of the land on this farm has a fair natural fall westward. Since the Lands Department have opened main water channels over this portion of the resumed Hamel Estate, the task of draining our place will be greatly facilitated by ploughing in narrow lands running east and west. The surplus surface water will be run into small drains which intersect the blocks at suitable intervals; these, when fully completed, will enable us to get rid of the excess of water in winter, and by so doing, obtain better results from the cultivated and pasture lands.

Live Stock.

Horses.—Two are kept. These are used for ploughing and general farm work.

Cow.—One milch cow has been lately added to supply milk for the ploughman's household.

Pigs.—Berkshire, pure bred, from selected imported stock. One boar and two sows are now kept for breeding purposes. They are doing well.

Poultry.—Fowls: Some choice pure bred White Wyandottes are kept for breeding purposes. Also some well-bred Indian Runner Ducks. These are all doing well, and will no doubt prove a useful, interesting addition to the farm stock.

Shade Trees,

useful and ornamental, have been planted near the homestead, around the pig and poultry runs. Included are a fair proportion of Adam figs. These by their rapid, vigorous growth provide good shade in summer, and bear excellent fruit—very useful for feeding pigs, sheep, and other live stock. Figs do well in this mild climate. They should be extensively planted by all progressive farmers in the South-West along boundary fences, and in groups in bare paddocks for summer shelter and fruit.

Date Palms (Phœnix dactylifera).—Strong suckers of these valuable trees have been lately imported from North Africa. They reached here in good order, and will be planted along the roadway leading to Samson's Brook on the homestead block.

Grasses.

About 150 varieties, obtained from different parts of the world, have been sown in trial plots. During the coming summer months these should prove instructive to all landowners interested in pastures. Several of the older kinds have given good results, namely, Rhodes Grass, Paspalum, African Wonder Grass, Sheep's Burnet, Bokhara Clover, Wallaby Grass, Tall Fescue, Panicum Prolutum, Cocksfoot, Timothy, and others are likely to be generally useful.

Wheat.

Eighty varieties of this cereal were grown on trial plots, both from imported and Australian seed. The latter gave the best results. All were diseased and damaged by the excess of wet during the sowing season and in spring. Taken as a whole the returns are poor and below those obtained in drier seasons. Yield rate per acre: highest, 21; lowest, 4; average, $8\frac{1}{2}$ bushels.

Oats.

Thirty-one varieties sown in drills on trial plots. Seed mostly imported from Europe and America. The local-saved selected seed gave the highest returns. All were damaged by wet soil, the grain was thin and light. Under more favourable conditions the results are far better. Yields poor: highest, 18; lowest, $7\frac{1}{4}$; average, $10\frac{1}{2}$ bushels per acre.

Barley.

Eleven varieties, mostly imported seed, including some of Garton's finest English malting sorts. The soil on this farm is not suitable for the profitable culture of this crop. Grain of good quality. Yields light: rate of highest, 11; lowest, 9; average, 10 bushels per acre.

Rye.

Five varieties grown, all from imported German seed. The plots of this cereal were sown rather late to give it a fair chance. Some gave fair returns, both in nice tall straw and good seed. Yields: rate of highest, $18\frac{1}{2}$; lowest, 6; average, 10 bushels per acre.

Maize.

Twenty-one varieties were cultivated in trial plots situated on the moist lowland along Samson's Brook. Although this soil is too light to enable this exhaustive plant to fill out its cobs properly, the results obtained were fairly even and profitable. Yields: rate of highest, 57; lowest, 18; average, 38 bushels per acre.

Rice (*Oryza sativa*).

Five varieties of this cereal were grown last summer on suitable moist soil. The two sorts named *Yamani* and *Bertone* matured the earliest, and gave very promising returns. Sown in October, they were harvested early in April. Yielding nice even grain at the rate of 900lbs. per acre. This valuable summer cereal plant may be profitably cultivated on warm moist land along the coast of this State.

Potatoes.

Those planted in spring comprised a large number of local seedlings raised on the farm during the previous autumn. Several of these gave fair results. The most promising have been carefully selected for further trial. The imported varieties, nine in number (including *Northern Star*), yields were good: rate of highest, 13; lowest, 5; average, $8\frac{1}{2}$ tons per acre.

Summer Crop.—Four sorts imported from the north of Scotland. Yields good: rate of highest, $9\frac{1}{2}$; lowest, 7; average, eight tons per acre. Some very prolific new seedlings were raised last autumn and will be planted in spring.

Cotton.

Gossypium herbaceum.—Last Spring about half an acre of suitable land was prepared and sown with this crop. Owing to cold wet weather the first lots of young plants perished. The seeds had to be re-sown three times. The year was far advanced before the young plants made satisfactory growth. Although they set bolls freely, these failed to ripen before the early autumnal rains set in, which discoloured the lint and spoilt its market value. Seven varieties were tried. The earliest and best was the short staple Louisiana Prolific. The crop is unreliable for profitable culture in this locality.

Hops.

Humulus lupulus.—In September a plot of suitable moist summer land was prepared by good tillage to a depth of 12 inches, and fertilised with bone-dust—rate of 6cwt. per acre. The sets imported from Victoria were planted 6 feet apart each way. The plants made fine healthy growth, attaining the height of 20 feet. The vines bore a nice crop of well-filled catkins. Picked 23rd February. Yield: rate of 2,500lbs. green, or about 800lbs. cured hops per acre.

Miscellaneous Plants.

A large number of these have been successfully cultivated here, including several new imported varieties of melons, pumpkins, and tomatoes; also artichokes, cowpeas, peanuts, and sweet potatoes. The three last did not give profitable results. The soil appears to be unsuitable for them.

Orchard.

In August four acres of land were well cultivated and planted with 400 selected fruit trees. Three hundred of these were imported from Victoria. The varieties number 190, including many new or rare ones not yet in general cultivation. Taken as a whole, the young trees have made strong, healthy growth, and are looking well. The losses were only one per cent.

Fig Plantation.

A block containing six acres, adjoining the orchard, was lately prepared and planted out with a selection of choice figs, including the Smyrna and Capri varieties imported from California.

Vine Cuttings.

A portion of this farm has been set aside to be used as a quarantine station for striking imported vine cuttings, and several small lots received were grown here during the past season. All being free from disease, they were lately sent to their owners as directed.

Insect and other Pests.

During the past season several injurious pests have been troublesome amongst cultivated plants, the Potato Moth being one of the worst. The small grubs of this moth bore into the growing stalks, causing them to die back. They likewise find their way into the tubers, close under the surface, and attack those in bags when stored. The common black leaf fungus also appeared on the potato foliage, which, although carefully sprayed, checked their growth, thereby reducing the yields.

Seeds and Plants.

Numerous applications have been received from residents in various parts of the State for trial lots of seeds and grass roots. When possible these have been supplied with directions for planting, etc.

Information Supplied.

Many queries relating to crops, seeds, mode of culture, etc., I have replied to by post. This part of the work is increasing, and takes up considerable time.

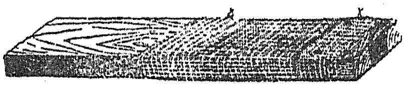
APIARY NOTES FOR SEPTEMBER.

By John Sutton, Bee Expert.

While there is every prospect of an early swarming season, it may not be quite safe to count upon it. Where records have been made, and providing the weather is such as to encourage brood rearing, care should be taken to keep in close touch, more particularly with those colonies that are not building up so quick as others; a little warm feed may assist and stimulate, and, should they not respond to such conditions, then it may be better to replace the queen, should another be available.

Those colonies that are building up and becoming strong in young bees should be seen to and inspected every nine days, so that the apiarist may judge as to the time they are likely to give off a swarm; this opportunity to get some young queens should be made the most of, and, where possible, not a single good queen cell should be lost, rather the opposite, as young queens from these early swarms should be taken care of to replace those getting old, or show sign of failing.

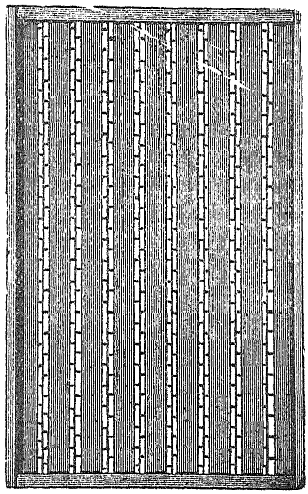
The majority of those who have made a close study of, and are bent on becoming honey producers, practise what is termed clipping, that is, one of the long wings on one side of the queen is cut off, the object of which is, to some extent, to prevent the swarm, when issuing, from leaving. Seeing the queen is not able to fly when the swarm issues it will circle about in the air for a little time, but unless the queen is with them they soon miss her, and as she will be flitting about somewhere in front of the hive some of the bees are sure to find her, and if the apiarist be on hand he should at once pick her up and cage her; a Miller's cage, as per illustration, is very handy for this operation.



Miller's Queen-catcher and Introducing-cage.

As soon as the queen is found and caged remove the hive from which the swarm has come, preferable, turning the hive facing the opposite direction, replace with another, which should be in readiness, placing the

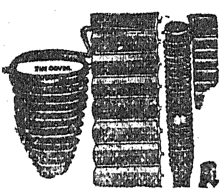
cage in the entrance of this, the new hive, and look sharp about it, otherwise the swarm will return, and if the apiarist is in the way of their flight they may hover round and discover the old hive and begin to enter it; this must be prevented if at all possible. If the new hive is in readiness it is only the work of an instant, and as soon as done get clear of the entrance, and the swarm will return and take possession. As soon as the bees begin to run in liberate the queen and she will soon mix with the rest, and your job is done. Perhaps it will be safer to see the queen enter the hive.



Honey-boards.

So soon as all the swarm is settled on front, or about the hive, open the old hive and find a frame with open brood, *i.e.*, eggs and unsealed brood. Place this in the centre of the new hive, being careful there is no queen cells either mature or just forming on this frame. Now if the swarm is good and strong, and had a super previous to swarming, place a honey-board over the brood frames, when the super may be removed from the old and placed on the new one over the honey-board. Most of the flying bees will return to the old stand and enter the new hive, which will further strengthen it, and from such colonies you may reasonably expect good returns, providing there is a good honey flow, and you give close attention, and keep adding room as it may be required.

Now let us return to the old hive, which, on opening, will be found to contain mostly young bees, as the swarm and the field bees have left it. It will, however, be found to contain several frames with capped brood that in a short time will hatch and make a fairly good strong colony. But look close over each frame, when you may find quite a number of fine-shaped queen cells, and these are too valuable, at this season of the year, to have destroyed. Let us look round; there are some failing queens, which we wish to replace. Take the frame into the workshop. Get a sharp penknife with this, warmed. Carefully cut out the best available cell. Place it in a cell protector. NOTE:—Handle carefully this cell, or you may crush the inmate. Don't turn it over, or you may injure the young queen. Keep it warm till you have found the old queen and removed her from the hive. This done, place the cup containing the cell in the warmest part of the brood nest, and leave your bees to do the rest.



West's Queen-cell Protector.

CELL PROTECTOR.

There are, may be, a number of other cells equally valuable left which it is desirable to keep. Get as many hives as you wish or there are cells available. Into these place one frame of brood with one cell. If one is found put this in the hive with all the bees on it. Find another frame with honey only. If you can borrow another from some super this may also

help, with the bees upon it. Take care here you don't carry a queen. Now close those frames up with a follower. Close the entrance so a single bee has a free passage. Make as many similar nucli as you have cells at your disposal. Sometimes most of the cells are found on one frame only. In this case they must be carefully cut out as above, and with a couple of pins they may be fastened on the side of the brood frame and placed in the centre of the cluster. If cell cups are available they may be used, but in this case the cell itself will be just as safe. In the case cited above the old queen had only been removed, and it would be risky to give the cell open, as they would almost be sure to destroy it before they knew they were motherless.

Of the two systems given it is always preferable to hatch out the queen and have a few bees care for her until she is fertilised. The risk of losing the queen is less, and, moreover, when a queen is removed and a cell given in place, it will take at least 10 days, perhaps more, before such a queen is ripe for mating and ready to take the place of the queen removed. Further, should she be lost, such loss may not be discovered until the colony is almost too weak to be of further service, at least for some considerable time.

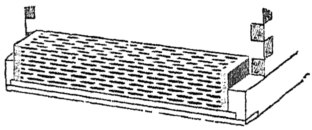
As soon as these small nucli are found to have laying queens, give them an occasional frame of hatching brood from some strong hive, thus adding young bees. Note: Be careful, when giving these frames, not to take a queen nor one single bee—it's risky to do it—only the frame, replacing such frame with another of worker comb or full sheet of foundation, and some little care should be exercised in doing this. While some spread the brood it is a system that, to say the least, is risky. Keep the brood as compact as possible while there is the least possible chance of having cool evenings.

Note.—There are one or two points, please note carefully, I have in the above notes presumed: the apiarist to be at hand during the swarming, or that someone who can care for the swarm is on the watch, and that all queens are clipped. When the queen is found and caged, and while the old hive is being removed and being replaced with the new hive, during this interval see that the queen is kept in a shady place; if alone, and the sun rays cover her, it will be *sudden death*. Better put her and cage in your pocket till all is ready to place the cage in the entrance.

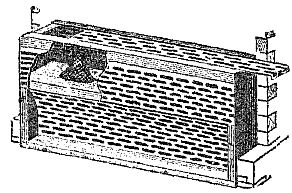
During the swarming season it is a good plan to have in readiness what we term a robber cloth. This may be a piece of light canvas or like material, about 22 inches or 24 inches wide and about 30 inches long. Take a piece of pine, $\frac{1}{4}$ inch by 1 inch thick, place this on one end of your cloth, and secure with a tack; another piece, same size, place on the opposite side of the cloth, and fasten together with inch nails; these pieces to be 24 inches long. Place these laths on both ends of the cloth, roll up when not in use, and whenever you have a hive open and have to leave it for a few minutes, take the free end of your cloth and fling the other over your hive, leaving the ends with the laths hanging down the sides of the hive. It is the work of just a moment, and you can leave it thus, secure from visitors or robbers, until you are ready to complete your operations safe and secure.

There may be someone who has not adopted the clippling plan, and are anxious to save their bees, when swarming, from roaming to pastures new, and others who only have a few hives and have not time to watch for swarms. To these let me advise to examine at least every nine days, and cut out every cell, if you do not want to raise young queens and if they must be left to

care for themselves. In this case the use of the bee-entrance guard or Alley's queen and drone trap would be found best and safest, as, when either are used, the queen cannot get out of the hive and the bees would return. With the Alley trap the queen would likely be found secure in a trap, and she could be returned or left until a young queen is hatched. In the latter case the trap must not be left too long after swarming or the young queen may attempt to leave and be caught and most likely killed, because the bees would care for the old queen in the trap quite a long while should she be left, and there is the risk of the colony being made queenless.



Bee-entrance Guards of Tinker Zinc.



Alley's Queen and Drone Trap.

UNRIPE EXTRACTED HONEY.

NOT PROFITABLE TO EXTRACT; INJURES SALE OF RIPE HONEY; HOW TO MANAGE SO AS TO LEAVE IT ON THE HIVE UNTIL ALL IS CAPPED.

To me the great problem confronting the extracted-honey producer to-day is the quality of a great part of the honey that is allowed to go on the market. What would have been beautiful honey if thoroughly ripened on the hive according to nature, before extracting, is often spoiled by ignorance or carelessness, or, worse still, by some unscrupulous bee-keeper who extracts about as fast as the bees store it, in the hope that, by some hook or crook, he can palm off the stuff at the regular market price, thus gaining the price of a few extra pounds he may get by this nefarious practice.

I am not one who thinks there is an over-production of *good* extracted honey; but the great trouble is, the large proportion of unripe or poorly handled honey finds its way to the market, and this has a tendency to keep down the price of the better grades of honey.

If the extracted-honey producers could be made to see how little there is gained in pounds by extracting unripe honey, or, in other words, how little the shrinkage is between thoroughly ripened and unripe honey, there would be very much less of the latter produced. One does not have to keep a colony on the scales very long to see that almost all of the evaporation, or shrinkage, is during the first 24 hours after the nectar is carried into the hive, so not much will be gained in weight of surplus unless the combs are extracted every day—a practice that I never heard of; but there is too much extracting done at about the time the honey is capped along the

top of the comb, for a little raw honey is thus mixed with the cured, ruining the flavour and body of the whole lot. One can, therefore, see how easy it is to lower the grade of a whole crop, causing it not only to sell very slowly but to hurt the sale of a good article.

What is the fraternity going to do about it? Educate? Let the bee-journals take up the cry, "A superior grade of extracted honey at a better price;" and by keeping the extra price at the front it will act as a stimulus for the production of a better article. After convincing a man that it is to his advantage to produce a superior article of honey, then the question of the sale of this superior honey comes in; but after producing a good many tons of first-class extracted honey, and selling it at from one to two cents a pound above the market quotations, I have proven that there is no difficulty concerning a market for fancy goods at a fancy price.

I will admit that there are seasons when it is hard, with any system, to produce a superior quality of honey; but these are exceptions rather than the rule.

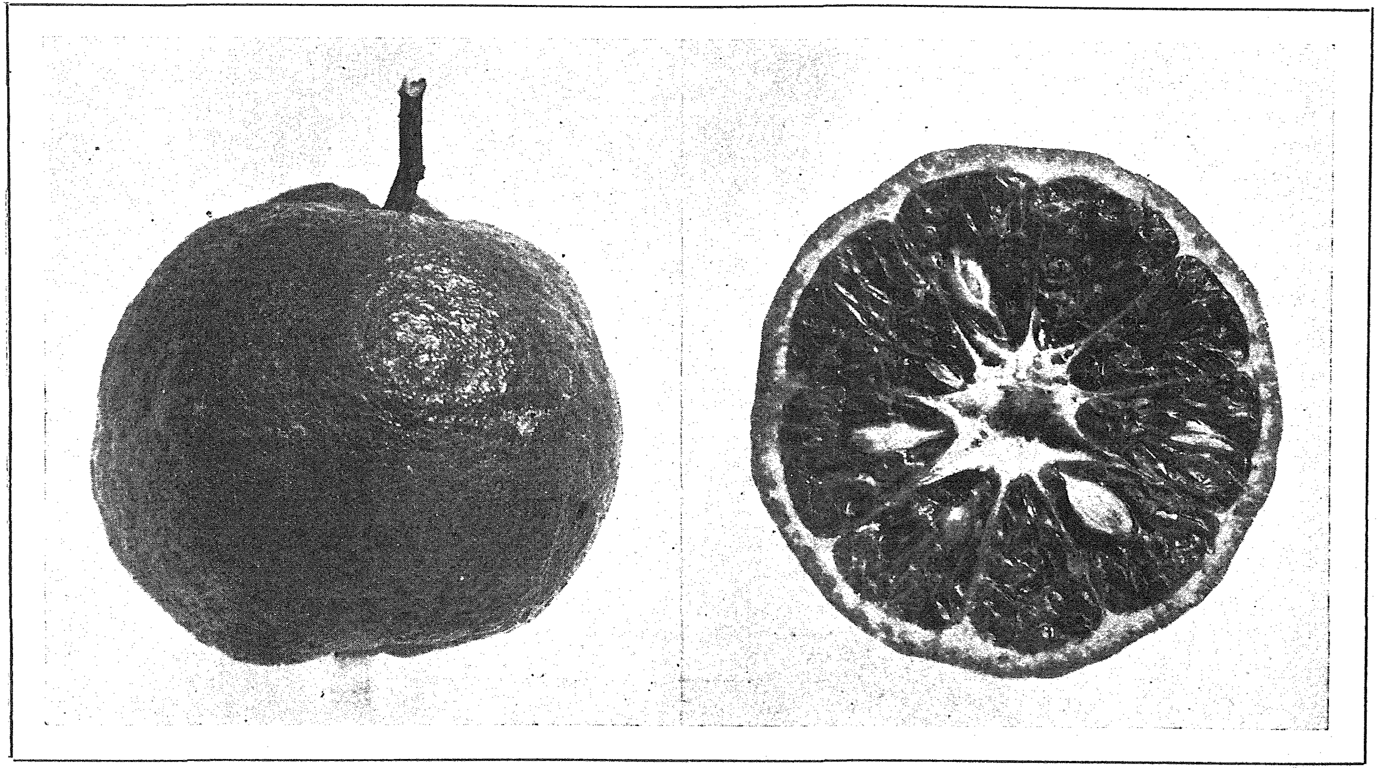
If we keep piling on upper stories clear through the season, being careful to give empty combs only as they are needed, and finally leaving the whole bunch on the hive ten days or two weeks after the season closes before extracting we shall not run very much risk. A good many may think they can not afford to have in stock this great lot of extra surplus combs; so, although I *earnestly* advise you to make the investment, I will tell you how to produce a good fair article, and do quite a share of the extracting during the honey-flow, without so many upper stories of combs.

In the first place, supply yourself with $1\frac{1}{2}$ sets of extracting-combs for each colony to be worked for surplus. If they are ten-frame size all the better; but eight-frame will do (I use eight combs in my ten-frame and seven in my eight-frame upper stories); but remember that you can not produce a good article of honey with only one set of extracting-combs to the colony. Put on the upper stories just as usual, as long as they last. If it is plain to see that the honey crop will be short, so that the $1\frac{1}{2}$ sets of combs will hold it all, let them stand on the hive ten days or two weeks, as stated above. If the honey season should continue, and more comb room is needed, go to the colonies that have two upper stories, look them over, and take the first one given them to the extractor. This oldest honey should be nearly all sealed by this time, and the raw thin honey that is being brought from the fields will be nearly all in the partly full story still on the hive. It will be better to extract just enough to give the needed empty combs, for, by so doing, the honey will remain on the hive as long as possible.

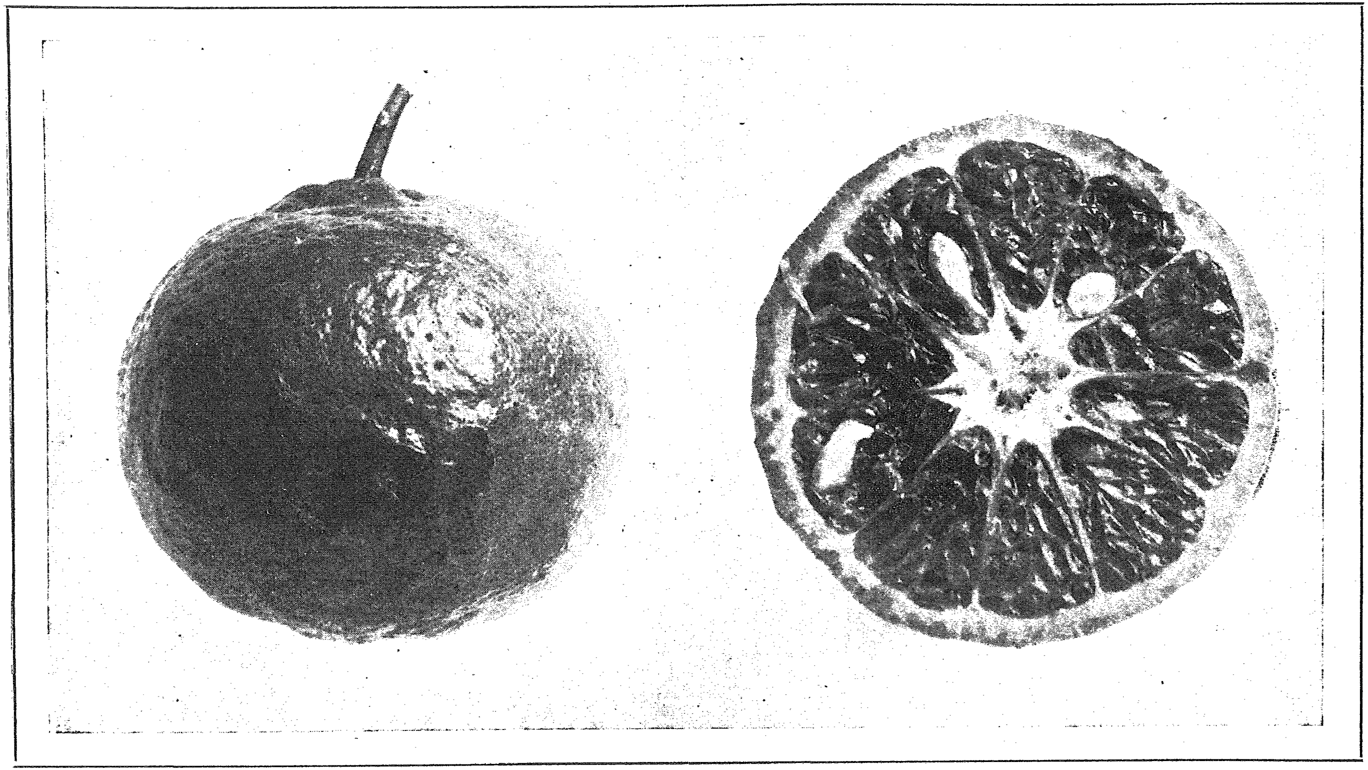
While this plan will not always bring the best results, still if there were no lower grade of honey put on the market than that produced by this plan there would not be the cause for complaint that there is to-day.

In conclusion, fellow bee-keepers, if you are among those who, in the past, have produced only an ordinary article of extracted honey, and have had trouble in selling it, you are invited to come over and share the advantages of a superior system. Do not put it off, for you are losing money every year.

Aside from the extra price, one has the satisfaction of knowing he will have pleased customers, so that every pound of this superior article that finds its way on the market will cause a demand for several more pounds.—*Gleanings in Bee Culture.*



"NAGPUR" ORANGE and section of same. (Natural size).



"SUNTOLAH" ORANGE and section of same. (Natural size).

INDIAN ORANGES.

By A. Despeissis.

The illustrations show two of four kinds of loose-skin oranges this Department introduced a few years ago from India.

The range of country suitable for orange culture may be said to cover in this State of Western Australia a territory as large as the British Isles.

Recently specimens of oranges and of mandarines grown at Nannine, in the Upper Murchison country, 300 miles inland from Geraldton, have been submitted to the Department of Agriculture and have been pronounced to be in size, colour, and flavour of exceptionally fine quality.

Thus the limits of what was once considered as the zone of country suitable to orange culture, and which was then narrowed to a long strip along the coastal line from Bunbury to the Murchison, has since been proved to extend to long distances inland, and also through the North-West, wherever fresh water can be tapped at a small depth in the soil and sufficient shelter can be secured, under rising ground, against the sweeping winds of the plain.

Over such a wide territory suitable for orange culture, it is evident that some varieties will be found in certain localities to be preferable to others.

In India the local loose-skin oranges have for ages past maintained their supremacy over many newcomers, and it is possible that in some parts of Australia, too, these Indian oranges may prove more profitable than others.

It is with the idea of testing these varieties that steps were taken to introduce them from authentic and reliable sources only, and through the courtesy of the Director of the Botanical Garden at Calcutta, plants of five varieties—the Sylhet, the Nagpur, the Suntolah, the Kowla, and the Mussembi—were introduced. Of these, two, the Nagpur and the Suntolah, have this season fruited, and a short description of the fruit, as well as illustrations taken from the locally grown oranges, are now given.

The "Nagpur" originates from the central province of Nepal, and is the orange chiefly sold on the Bombay market. The fruit is much like the "Sylhet" of Eastern Bengal and in appearance not unlike a Scarlet mandarin, but the skin is not so puffy and the segments are closer together. The tree is more spreading than the Sylhet.

The "Suntolah" is a little smaller and not so flat as the Nagpur, the skin is not so loose as with that variety. It promises to prove a good carrier. One peculiarity is that this orange is sweet when still green, and when coloured and quite ripe it is extremely sweet. The tree is bushy and does not attain great dimensions.

It naturally grows wild in the hot, humid foothill country which extends between the Ganges and the Himalayas, and is very hardy. It is said the fruit is reproduced true from seed.

WEST AUSTRALIAN MINERAL PRODUCTION.

The Statist, Department of Mines, has provided the *Journal* with the following table of returns of the Gold Production of Western Australia from 1st January, 1886, to 31st July, 1905:—

GOLD.

GOLD PRODUCTION OF WESTERN AUSTRALIA FROM 1ST JANUARY, 1886, TO 31ST JULY, 1905.

Year.	Grand Total.					
	Export.	Mint.	Total.	Value.		
	Fine ozs.	Fine ozs.	Fine ozs.	£	s.	d.
1886	270·17	...	270·17	1,147	12	2¼
1887	4,359·37	...	4,359·37	18,517	8	6¼
1888	3,124·82	...	3,124·82	13,273	7	10
1889	13,859·52	...	13,859·52	58,871	9	11¾
1890	20,402·42	...	20,402·42	86,663	19	5¼
1891	27,116·14	...	17,116·14	115,182	0	10
1892	53,271·65	...	53,271·65	226,283	11	8½
1893	99,202·50	...	99,202·50	421,385	8	8½
1894	185,298·73	...	185,298·73	787,098	19	6
1895	207,110·20	...	207,110·20	879,748	4	2¼
1896	251,618·69	...	251,618·69	1,068,808	5	2
1897	603,846·44	...	603,846·44	2,564,976	12	9¼
1898	939,489·49	...	939,489·49	3,990,697	13	10
1899	1,283,360·25	187,244·41	1,470,604·66	6,246,731	10	7¾
1900	894,387·27	519,923·59	1,414,310·86	6,007,610	13	4½
1901	923,686·96	779,729·56	1,703,416·52	7,235,653	9	1
1902	707,039·75	1,163,997·60	1,871,037·35	7,947,661	9	7¾
1903	833,685·78	1,231,115·62	2,064,801·40	8,770,718	17	0¼
1904	810,616·04	1,172,614·03	1,983,230·07	8,424,225	17	3¾
Total	7,861,746·19	5,054,624·81	12,916,371·00	54,865,256	11	9
1905†	395,666·77	735,708·24	1,131,375·01	4,805,775	11	5
TOTAL	8,257,412·96	5,790,333·05	14,047,746·01	59,671,032	3	2

† 31st July.

MINERALS OTHER THAN GOLD.

Latest available Return (to 30th June, 1905) of Ore and Minerals, other than Gold, showing the Quantity produced and the Value thereof, as reported to the Mines Department from the respective Goldfields and Mineral Fields during 1905 and previous years.

Year.	Month.	Copper Ore.											
		Day Dawn D.		Mt. Malcolm D.		Northampton Mf.		Phillips River Gf.		West Pilbarra Gf.		Total.	
		Quantity	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
		ton	£	tons.	£	tons.	£	to s.	£	ons.	£	tons.	£
Previous to 1899	...	..	...	...	...	...	...	..	...	7,018·00	55,270	7,018·00	55,270
1899	...	...	...	273·00	4,338	136·00	2,122	.	...	2,555·00	29,478	2,964·00	35,938
1900	..	5·15	91	4,539·00	30,718	...	...	34·00	725	1,605·00	12,139	6,183·15	43,673
1901	...	10·50	76	7,660·00	40,738	38·50	277	1,089·14	12,918	1,162·00	15,891	9,960·14	69,900
1902	...	...	...	1,954·00	6,852	...	...	308·25	1,238	...	...	2,262·25	8,090
1903	...	...	...	18,965·00	45,557	...	...	1,561·33	10,984	...	...	20,526·33	56,541
1904	...	...	...	500·00	900	...	...	3,468·89	24,280	...	...	3,968·89	25,180
	Total ...	15·65	167	33,891·00	129,103	174·50	2,399	6,461·61	50,145	12,340·00	112,778	52,882·76	294,592
1905	Jan'y—June	...	...	60·00	674	...	...	1,285·26	8,591	...	...	1,345·26	9,265
	Total ...	15·65	167	33,951·00	129,777	174·50	2,399	7,746·87	58,736	12,340·00	112,778	54,228·02	303,857

MINERALS OTHER THAN GOLD—*continued.*

Year.	Month.	Ironstone. West Pilbarra Gf. Quantity.	Ironstone. West Pilbarra Gf. Value.	Ironstone. State generally. Quantity.	Ironstone. State generally. Value.	Ironstone. Total. Quantity.	Ironstone. Total. Value.	Lead Ore. Northampton Mf. Quantity.	Lead Ore. Northampton Mf. Value.	Silver Lead Ore. Ashburton Gf. Quantity.	Silver Lead Ore. Ashburton Gf. Value.
		tons.	£	tons.	£	tons.	£	tons.	£	tons.	£
Previous to 1899 ...	...	100·00	300	...	...	100·00	300	...	...	...	...
1899	...	...	...	12,852·00	8,939	12,852·00	8,939	82·75	912	...	...
1900	...	...	...	12,251·00	9,258	12,251·00	9,258	268·00	533	...	...
1901	...	...	...	20,569·00	13,246	20,569·00	13,246	...	...	21·05	152
1902	...	...	...	4,800·00	2,040	4,800·00	2,040	...	...	35·85	277
1903	...	...	...	220·00	88	220·00	88	...	...	...	...
1904	...	...	...	1,441·50	577	1,441·50	577	...	...	...	...
	Total ...	100·00	300	52,133·50	34,148	52,233·50	34,448	350·75	1,445	56·90	429
1905	January—June	...	...	2,345·60	938	2,345·60	938	...	...	...	...
	TOTAL ...	100·00	300	54,479·10	35·086	54,579·10	35,386	350·75	1,445	56·90	429

MINERALS OTHER THAN GOLD—*continued.*

Year.	Month.	Coal. Collie River Coal Mf. Quantity.	Coal. Collie River Coal Mf. Value.	Limestone. Yilgarn Gf. Quantity.	Limestone. Yilgarn Gf. Value.	Limestone. State generally. Quantity.	Limestone. State generally. Value.	Limestone. Total. Quantity.	Limestone. Total. Value.	Diamonds. Nullagine D. Quantity.	Diamonds. Nullagine D. Value.
		tons.	£	tons.	£	tons.	£	tons.	£	carats.	£
Previous to 1899...	...	3,508·00	1,761	...	...	...	...	...	...	...	...
1899	...	54,336·00	25,951	...	...	17,593·00	2,838	17,593·00	2,838	*	24
1900	...	118,410·10	54,835	269·85	273	15,657·00	3,321	15,926·85	3,594	...	...
1901	...	117,835·80	68,561	1,642·00	919	16,568·00	3,429	18,210·00	4,348	...	...
1902	...	140,883·90	86,188	535·00	340	4,545·35	1,000	5,080·35	1,340	...	...
1903	...	133,426·62	69,128	102·00	75	1,177·50	103	1,279·50	178	...	...
1904	...	138,550·04	67,174	...	...	13,397·20	1,699	13,397·20	1,699	...	...
	Total ...	706,950·46	373,598	2,548·85	1,607	68,938·05	12,390	71,486·90	13,997	...	24
1905	January—June	63,278·28	30,005	...	...	5,345·60	642	5,345·60	642	...	...
	TOTAL ...	770,228·74	403,603	2,548·85	1,607	74,283·65	13,032	76,832·50	14,639	...	24

NOTE.—As the collection of Statistics of Minerals other than Gold commenced during 1899, the total Production from the different localities can only be approximately estimated by the Customs Records, the latest available returns of which are to be found in Table XXI., pages 96-99, of the Annual Mining Statistics of the Department of Mines for the year 1903. * Weight unknown.

MINERALS OTHER THAN GOLD—*continued.*

Year.	Month.	Black Tin.					
		Greenbushes Mf.		Marble Bar D.		Total.	
		Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
		tons.	£	tons.	£	tons.	£
Previous to 1899 ...	...	1,590·33	66,108	75·45	4,419	1,665·78	70,527
1899 ...	...	277·32	21,658	57·50	3,612	334·82	25,270
1900 ...	...	435·62	29,528	387·87	27,174	823·49	56,702
1901 ...	...	321·34	18,852	412·98	21,148	734·32	40,000
1902 ...	...	403·21	24,680	216·35	15,103	619·56	39,783
1903 ...	...	524·94	34,362	292·11	21,528	817·05	55,890
1904 ...	...	533·64	34,462	320·86	24,355	854·50	58,817
	Total ...	4,086·40	229,650	1,763·12	117,339	5,849·52	346,989
1905 ...	Jan.-June	281·85	21,448	175·15	12,553	457·00	34,001
	Total ...	4,368·25	251,098	1,938·27	129,892	6,306·52	380,990

POULTRY FARMING ON THE GOLDFIELDS.

By FRANK H. ROBERTSON.

The large goldfields centres of Kalgoorlie and Coolgardie contain a population which consume enormous quantities of eggs, by far the greater proportion of which are imported from South Australia. One enterprising firm at the Boulder has for several years past conducted an extensive wholesale business in eggs alone, all of which are imported in large, specially-made casks to hold from 250 to 300 dozen eggs. They are well packed in chaff, and carefully graded by candling, only fresh ones being sold to the storekeepers, staler eggs being disposed of at lower rates for confectionery purposes.

There is almost an entire absence on the goldfields markets of eggs from the farmers of the coastal districts of this State; but as a great many persons keep fowls on the goldfields, the newly-laid egg is not as scarce as one would think, and as poultry farming is being energetically taken up, the supply is, in the near future, likely to be very much increased. Last month I visited the goldfields for the purpose of judging at the Coolgardie and Menzies shows, at both of which places were very excellent displays. The latter, in particular, was quite a surprise, considering its distance from what are generally considered the poultry-raising districts. Several of the best

exhibits were locally bred. Between the dates of the two shows an inspection was made of some of the poultry farms already referred to.

The Coolgardie Poultry Farm.

The first one visited was the Coolgardie Poultry Farm, which was started about 18 months ago by a local medico, who went to the expense of importing all the stock birds from America, also incubators and appliances, and sent his own man to select the stock and bring them here. They consisted of 60 White Wyandottes, 60 White Leghorns, 80 Pekin ducks, three trios of bronze turkeys, and a pen of Emden geese. The Wyandottes, Leghorns, and ducks contain very few specimens up to show standard, being all small and tight in feather, the Leghorns in particular being what we would call weedy; small in comb and lobe, but as the birds were selected from laying strains, utility qualities are solely looked for in this establishment. A good egg supply has preference to handsome looks. The Emden geese are good, weighty specimens, but the bronze turkeys are the finest-looking birds on the farm, some of them being prize takers in American shows—great size, good bronze colour, and markings. A gobbler shown at the Coolgardie show was well up to standard weight, going 34lbs.; and the hen 19lbs.

The farm is situated about two miles west of the town, close to the railway line, and contains an area of about 10 acres of rich, red soil, thickly covered with small undergrowth, which has stupidly been cut down very much in some of the pens. This fault can, however, be be rectified by carrying the runs back into the scrub land, or perhaps it would be better to remove some of the fencing to better sheltered spots. The runs, numbering 26, are large, and good substantial houses have been erected of hessian and iron, being very conveniently erected right on the front boundary. The feeding arrangements are also very handy; a trough is fitted on to the fence with slatted front; the fowls can thus get their soft feed perfectly clean, and the attendant does not require to go into the pens. The incubator room, 20ft. x 20ft., is underground, and instead of being covered with the usual earth roof, the feed room is built over it, which is a very handy arrangement and serves to keep the incubator room at a cool, even temperature. The walls of the feed room look well, made of stout hessian, covered with a wash of lime and raw oil; the oil is poured in while the lime is boiling. Four 350 Cypher machines are in use, and four more are ordered for the present season, thus making a total egg capacity of 2,800. A small electric light is laid on close to the thermometer in each machine, and by pressing a button a very distinct reading can be obtained of the temperature. The arrangements are good for housing the chickens; long runs, well covered with boughs, afford good shade from the sun. Several Prairie State Brooders are used. These are on a different principle to the ordinary type of hot-air pipes or hot water. The heating chamber is loosely packed with asbestos, through which the hot air from the lamp slowly percolates. A complete Cypher Brooder plant is on order to accommodate 3,000 chicks for a start. The boiler system is to be adopted, that is, a supply of hot water is obtained from a fixed boiler, from which the water is circulated by pipes running the whole length of the brooders; their number can be extended as desired and fresh lengths of piping added. In the incubator room is a handy contrivance in the shape of a revolving egg cabinet. It is fitted with 15 shelves, which firmly hold each egg, as in the ordinary patent egg-carrier; 1,050 eggs can be stored, and by releasing a bolt the cabinet revolves, thus

turning the whole of the eggs in the time that a dozen could be turned in the ordinary way.

All food is bought, and consists of wheat, bran, and pollard. Green feed is obtainable in abundance from a market garden close at hand, and a good supply of animal food is got by using blood from the slaughter yards, also near by. Water is laid all over the runs from the Coolgardie water supply. A ton of special chicken food was imported from America at a low rate. Eggs for the table and young fowls (broilers), 2½lbs. to 3lbs. weight, form the two sources of income, for both of which there is an unlimited demand. The farm is under the management of Mr. J. Watterson, who brought the stock from America, and while there he had a good look round several of the large plants; and, during an hour's chat, he gave many interesting details as to how things are run in the land of Stars and Stripes. Their straigtforward way of dealing very favourably impressed him; and the readiness in imparting the fullest and most reliable information on all points appertaining to the vast industry as conducted there was much appreciated and fully availed of. Another thing that struck him was the feeling of good comradeship that exists amongst the various poultry farmers, and the willingness to assist one another in the event of difficulties occurring which want careful elucidation, such as diseases, faults in hatching operations, or any of the many mishaps which will happen on establishments running things on a large scale. A remarkable thing which also struck him was the closeness of the quotes as to prices on the various farms, the variations being very slight; and in pricing birds there was an absence of any desperate pushing for sales; but, on the other hand, a desire expressed for the buyer to take his time, and even mentioning other farms in the vicinity where the birds required could also be obtained. The manager (Mr. Watterson), who is an old sailor, experienced very bad weather on the trip from America, but only lost one or two birds. He is exceedingly energetic and enthusiastic in his work. The plucky proprietor, who has gone to great expense in setting this farm going, has a manager who will make the venture a pecuniary success if it is to be done at all, and I fail to see any reason why this farm should not amply fulfil expectations. There is an excellent local demand for all their products, at good prices. It then rests with the management to keep up a sufficient supply to pay expenses and show a profit on capital laid out.

Mr. W. R. Hall's Garden and Poultry Yards.

About 1½ miles west of Coolgardie beyond Bayley's is the Miner's Homestead Block of 20 acres occupied by Mr. W. R. Hall. He is an orchardist by training and has fruit trees here thriving and bearing well. The trees are about four years old, and by trenching 2½ feet deep moisture is retained to keep the trees in good health right through the blazing hot summer without watering. He has a quarter acre in vines—viz., Black Hamburg, Wortley Hall, Golden Chasselis, and Muscat—and obtained a crop of 15cwt. of grapes, which sold locally at 5d. per lb. The fruit trees consist of apples, viz., Rome Beauty, Jonathan, and Cleopatra; peaches, Brigg's Red May, Comet, and Early Rivers; also apricots. Two acres were also put down for wheat. Mr. Hall has recently taken on poultry, and gone in almost exclusively for pure Brown Leghorns for egg production, and by the aid of trap nests has selected six hens which gave the fine average of 197 eggs per hen for the 12 months; last season he hatched 500 chickens from one small "Reliable" incubator, which is kept in a small but well ventilated underground room. There are six breeding pens, and the houses, though roughly constructed, are

his methods and description of his yards. I saw several of his stock at the Menzies show, his Silver Wyandottes being of extra quality, quite good enough to hold their own in the strongest competition.

His breeding pens consist of six runs, each 75ft. x 15ft., and three 75ft. x 8ft. The houses are all of iron, 10ft. x 10ft., built in two rows. There is a scratching-shed to every pen; the runs are kept perfectly clean by sweeping once a week; and, by a plentiful supply of boughs, the birds are well protected from the sun. The breeds kept are Silver Wyandottes and White Leghorns, the original stock having been imported from good New South Wales yards. A 100-egg Nonpareil incubator is successfully used; over 200 chickens were reared last year, and there is a ready sale for eggs for setting and for the table; pure-bred chickens are sold, and stock for show and breeding purposes; culls are sold to the hotels at Menzies. Animal food is obtained in the form of fresh bones, which come by rail from Kalgoorlie; a Mann's cutter is used to cut them up. Greenstuff is scarce at summer-time, but silver beet grows well; this is supplemented by using steamed chaff.

Mr. Howe makes his poultry pay well, and intends going in for them on a much larger scale.

A Menzies Pig and Poultry Farm.

At Menzies, Messrs. Smith & Taylor run a neat little pig and poultry farm, utilising all the waste food from their hotel. A large number of common and cross-bred fowls are kept, also ducks, and American bronze turkeys. Mr. Smith, the partner who manages the farm, is also a fancier and was a very successful exhibitor at the local show, winning with White Leghorns, Gold and Silver Wyandottes (which are kept in neat well-shaded pens), with birds of first-class quality. He is also the hon. secretary and general manager of the show, and by his energy keeps alive the interest in poultry breeding in this district.

The Kalgoorlie Duck Ranche.

The last place to inspect was the Carisbrook Duck Ranche and Poultry Farm at Kalgoorlie. This fine farm was fully described in the *Journal* of August, 1904. Since my visit, just 12 months ago, I found many improvements have been made. The brooder houses have been enlarged. No. 1 is the hot brooder house, walls of stout canvas, roof iron, it is 60 feet long, 12 feet wide, fitted with a canvas blind to cover the front at night time; it contains four Cypher brooders of four sections each, heated by eight lamps. This house accommodates 1,200 ducklings for the first month; there are wire-netted runs attached to the brooders, which are partly covered with canvas to guard against the sun. All dirt is cleaned out every day, and an inch of fresh dry sand put in. Adjoining the above is the cool brooder house, 120 feet long, of similar construction, with 20 wired runs attached, each six feet wide, to hold 50 ducklings in each run; here they stay for another month, then pass on to the fattening pens. An illustration of these houses will be given in next month's issue, as time will not permit of reproducing this month. The incubator plant remains the same as last year, viz., 6,000 egg capacity; the only change made in the working being that moister air is required. This is supplied by keeping the ground under the machines always in a wet condition. The system of feeding the ducks remains the same as before; the only change is in going in more for the sectional brooder system

in place of the separate out-door brooders, which are found more suitable for chicken rearing. Several additions have been made in other parts of the farm. A very fine pen of typical Indian Runners, from Horan, of Gingin, has been added; also two good pens of typical Buff Orpingtons and one of Minorcas. In these runs very attractive and neat-looking fowl-houses have been erected, made chiefly from disused condenser tanks, of which there is a good supply obtainable owing to the water scheme superseding condensing plants.

The output of ducks for the past year shows a big increase—viz., 7,400 against 3,300 for the previous year. In addition to the pure-bred poultry above mentioned, good pure Brown Leghorns are also largely bred, and some hundreds of crossbreds; also a pen of pure Pekin ducks. The number of stock ducks has also been increased from 480 to 600.

A carpenter is kept at work all the year round gradually building up improvements, which, I presume, have now almost reached their limit; and as the farm now stands, Mr. Fuller says that his plant is the largest and most complete of its kind in the Commonwealth; and so far as I know, I do not think there is any to compare with it. It is certainly now a very complete and extensive poultry-breeding establishment, and should prove a very profitable investment for its enterprising proprietors.

THE GOVERNMENT LABOUR BUREAU.

REPORT FOR JULY.

Mr. Jas. Longmore, Superintendent of the Government Labour Bureau has forwarded to the Minister for Labour the following report on the work of the Bureau for the month of July, 1905:—

PERTH.

Registrations.—The total number of men who called during the month in search of work was 758. Of this number 371 were new registrations and 387 renewals, *i.e.*, men who called who had been registered during the year prior to the month of July. The trades or occupations of the 758 applicants were as follows:—Labourers, 220; handy men, 65; handy lads, 65; farm hands, 53; bushmen, 44; cooks, 32; carpenters, 28; drivers, 17; gardeners, 15; painters, 15; grooms, 14; fitters, 12; hotel hands, 11; miners, 11; yardmen, 11; clerks, 10; blacksmiths, 9; caretakers, 6; plasterers, 6; plumbers, 6; butchers, barmen, carpenters (rough), and station hands, 5 of each; bricklayers, dairymen, grocers, and kitchenmen 4 of each; brick-makers, joiners, orchardists, orderlies, strikers, and stewards 3 of each; boilermakers, bookkeepers, coachmen, firemen, farriers, jewellers, shearers, storemen, wheelwrights, and waiters 2 of each; and 34 miscellaneous.

Engagements.—The engagements for the month numbered 196. The classification of work found was as follows:—Labourers, 71; bushmen, 22; handy lads, 15; farm hands, 14; handy men, 13; woodcutters, 11; boys for farms, 7; cooks, 7; carpenters, fencers, kitchenmen, married couples, and plasterers, 3 of each; carpenters (rough), grooms, gardeners, gardeners (market), grocers' assistants, hotel hands, orchardists, and yardmen, 2 of each, and 5 miscellaneous.

Fremantle.

Registrations.—The applicants for work numbered 148. There were 79 new registrations and 69 renewals.

Engagements.—The engagements numbered 30, classified as labourers.

The female servants who called numbered 14. There were no engagements.

Kalgoorlie.

Registrations.—There were 147 new registrations and 44 renewals.

Engagements.—There were 16 engagements, classified as follows:—Engine-drivers, 6; labourers, 3; carpenters, 2; miners, handy youths, yardmen, fitters, and handy men, 1 of each.

The female applicants for work were 82. There were 51 new registrations and 31 renewals. The engagements numbered 12, classified as follows:—Generals, 8; charwomen, kitchenwomen, cooks, and waitresses, 1 of each.

Cue.

There were no applicants for work.

Women's Branch, Perth.

Registrations.—The women who applied for work numbered 228. There were 119 new registrations and 109 renewals.

Engagements.—The engagements totalled 76, classified as follows:—Generals, 20; laundress-charwomen, 18; light generals, 13; useful girls, 10; housemaids, 4; lady-helps, 4; cooks, 3; cook-laundresses, 2; nurse-needlewoman and married couples, 1 of each.

General Remarks.

The number of individual men who called at the central offices, Perth, during the month was 758. This total is 11 short of the number for June, and 132 short of that for July last year. The engagements were 196, being 15 in excess of the number for June, and 25 short of the total for July last year. Of the 196 engagements, 191 were by private persons, this being 18 in excess of that for July, 1904.

The arrangements for the transfer of the Labour Bureau to more commodious premises situated in Irwin Street, will, it is hoped, be completed in time to enable the Labour Bureau to occupy the new premises during August.

NEW FORMS OF PLANT LIFE.

(*Continued*).

Along the Atlantic seaboard, dipping down to the Gulf of Mexico and thence upward to portions of the fruit-producing Pacific-coast States, is a strip of land, varying in width and distance from the sea, where fruit-trees start into growth early and are subjected to late spring frosts. On account of these conditions, certain fruits, as the peach, nectarine, and plum, become problematical crops. Mr. Burbank, who sees far as well as deep, looked at the needs of this frost-troubled region. He saw the conditions, and determined to breed the fruit to fit the climate, not only sturdy and prolific, but frost-resistant. Now, after years have elapsed, he has produced fruit trees of these types that will withstand absolute freezing in bud and flower. The foliage and petals may be stiff with ice; yet when the warm sun has come again, the leaves show no sign of the deadly blight of the frost. How shall we estimate, even in dollars, what such a feat as this means to the world?

But consider another new achievement, performed not so much as a duty to the world as for the world's delight. Among all the diverse elements of Mr. Burbank's nature, none is more conspicuous than his love for the beautiful. He stood looking at a bank of flowers one day when the golden glory of the California poppies had turned the brown mesa to a mass of splendid colour—a gorgeous, imposing bloom, taken in the mass. His quick eye caught sight of one poppy that bore a faint stain of red—a narrow pinkish line drawn down its satin chalice of gold.

This single poppy was jealously guarded. Next season its seeds were planted. From thence came a brood of poppies, some as yellow as their forbears, some showing still greater hints of the crimson. The yellow ones were destroyed and the others retained, and their seeds in turn planted. An increasingly large number of reddish ones appeared the next generation. Day by day through the years as the poppies opened to the sun, they were challenged with the utmost rigour; none was allowed to live which persisted in wearing its yellow coat.

At last, after years had lapsed, the test was brought to a successful end; and in the season of 1904 a new floral wonder was produced—a brilliant crimson poppy made from a yellow one, the other characteristics, length and shape of petal, size of flower, and integrity of all its parts being left undisturbed.

Other members of the poppy family have interested Mr. Burbanks. By crossing the common garden poppy, which is a short-lived annual, with the Oriental poppy, a perennial, he has produced a new race of poppies combining every desirable quality of both species in one, and developing numerous wholly new forms having enormous size, greatly enhanced beauty of colours, improved lasting qualities, and possessed of perpetual blooming powers. He is now carrying on some remarkable experiments with these flowers. He has so far transformed the ordinary poppy that it measures fully ten inches across, an enormous bloom, preserving all its original beauty, immensely enhanced by its size.

The production of these great blossoms has been accompanied by some of the strangest developments in all this wonderful work. In November last, in a plot of ground perhaps fifty feet square, set apart on his testing field at Santa Rosa for experimentation in poppies, I saw growing two thousand poppy plants, and no two of them were alike. Nothing stranger in plant life ever before developed. Some of them bore great quantities of seeds, but not a single flower Some bore beautiful flowers in great profusion, but not a single seed. Some bore flowers arranged in the most fantastic shapes, as flowers surrounding the seed-capsules, and seed-capsules surrounding the flowers. Some strange ones bore neither seed nor flowers.

Taking in his hand a late poppy-bloom, a splendid scarlet flower, though the season was fast waning, Mr. Burbank held it up and said :

"If you wish, I can quarter the seed-capsule within this flower, and, by pollenising sections, grow from one quarter annual plants ; from another quarter, perennial plants ; from the third quarter, crimson poppies ; from the fourth, white ones."

Yet never for an instant has Mr. Burbank set claim to anything but the application of unalterable laws—laws discovered by him in new relations that are overturning some laws long held by the scientists, but laws immutable to the end of the chapter.

The initial work on the poppies began with the pollen of a single Oriental flower, *Papaver orientale*, a perennial, and the seed of the opium-poppy, *Papaver somniferum*, a short-lived annual. The first generation showed little variation, except in colour ; the second and succeeding ones leading up to the marvellous variations already noted.

Leaving untold much that is of deep interest concerning the work, one may not more than suggest here a few of the other achievements of Mr. Burbank. It must be borne in mind that he has under way investigations which promise greater results for the beauty and the utility of the world than anything he has yet done. So far he has carried on over two thousand five hundred distinct species investigations, the problems of many of which are yet unsolved. The following is a recapitulation, necessarily brief, of things already done, in addition to those which have been under consideration :—

The creation of the fastest-growing tree in the temperate zones of the world—a walnut which in thirteen years has grown to six times the size that an average walnut has grown in twenty-eight years. The shells of the walnut were bred so thin that birds could pick holes in them, so that it became necessary to reverse the process, breeding back until the shells have become of the requisite thickness. The meat of the walnut has been made white, all the tannin, or bitter qualities, having been driven out.

The "plumcot," a combination of the common American wild plum, a Japanese plum, and the common apricot, producing a fruit unknown to the world before, with a delicious flavour, unlike either of its ancestors, and plentiful in nutrients and beautiful in colour. Incidentally, the plumcot, with the primus berry, disproves the dictum of scientists that new species cannot be produced by man.

An amaryllis ten inches in diameter, maintaining the beautiful colours of the choiciest small blooms. Rare and beautiful gladioli, also, Mr. Burbank having compelled the gladiolus to bloom around the entire stalk, like the hyacinth, a thing never before known.

Many varieties of plums of rare colour and quality as well as of great vigour, among them the Wickson, which is supplanting other plums and has already added greatly to national wealth in various parts of the world.

A numerous family of plums with no pits and only the suggestion of seeds within them, the fruit of which can be cut in twain with a penknife. Further work to improve them in size, colour, and quality is now going on.

A chestnut tree which bears nuts at eighteen months of age, and which has borne them at six months. The tree bears when not over three feet in height.

Many varieties of lilies of great beauty and improved character which will be introduced as soon as a sufficient stock can be produced.

The smallest calla ever known, less than an inch and a-half in diameter, bred downward to show that plants can be reduced as well as enlarged to suit the wishes of man.

A dahlia bred from the old, ill-smelling type up to a flower having the odour of the magnolia. In addition, the flower itself has been led to take on new forms of beauty, some of them strangely like the chrysanthemum.

The Shasta Daisy, a blossom from five to seven inches in diameter, brought up from the tiny field daisy, one of the pests of the eastern farmer.

Rhubarb, which yields every day in the year, and of rare quality. The leaves of a single stem measure four feet in length by three feet in width.

An improved prune averaging from four to six times the size of the French prune from which it sprang, and very rich in sugar.

The "pomato," one of the most wonderful creations, now under way. This may be called a tomato growing upon a potato. It produces in abundance a white, fragrant, succulent, delicious fruit upon the potato-tops, something unlike any fruit ever known before, and may be eaten cooked or as a salad, or as other fresh fruits, the flavour resembling the "po-ha" berry of the Hawaiian Islands.

A blackberry without thorns. Other thorn-bearing berries and roses are to be denuded of their thorns as soon as time can be given to the work.

The Australian star-flower, so improved that it now bears a beautiful rose-pink and white blossom, much larger than the original. It is new, fragrant, "everlasting" flower, and can be introduced in the decoration of ladies' hats and for other millinery uses, reducing greatly the cost of artificial flowers.

A wholly new larkspur, much enlarged in size, and given a delicious odour. The colour combinations are far finer than those of the common larkspur, but still of intense shades.

These are only a few of the new creations already achieved, or upon which Mr. Burbank is engaged. The work already accomplished or yet to be done covers a field of life in the vegetable kingdom, rich in beauty and service to mankind.

But how does Mr. Burbank work his wonders? Here are two plants —one from Australia, perhaps the other from Siberia. Each plant has its characteristics, its life-habits, its structure, its hereditary tendencies— a life distinct from all others. Each has preserved its identity a thousand years, perhaps ten times ten thousand years, not varying to any great extent

through the long centuries. He takes these two plants and gives them the opportunity to unite. Struggle as each may, with the fervour of ten thousand years of habit all powerfully upon it, it cannot overcome the change.

The pollen from one of the flowers has found its way to the stigma of the other, borne by the sensitive finger-tips of a man accustomed to wait with patience the outcome of his projects. A year passes. The seed from the new plant is planted. From it may come a plant like both of its ancestors, or like neither—like nothing yet born in the vegetable life of the world.

And this is what is sought: to make it different, to break up its life tendencies, to recombine the hereditary influences of its ancestry. In the breaking-up it may produce a whole series of monstrosities, the most strange and grotesque plants that ever took root in the soil of the earth. Some of these plants are hideous, and all such are put to death. For the object is not to produce abnormality, but a splendid norm, a plant which shall have the best characteristics of both parents and become a new and powerful factor in the beauty or the utility of the race. The next year and the next there are more seeds and more plants; and in a few years, so great is the progression, there may be 500,000. Bear in mind that some of the greatest botanists of this and other days have carried on their investigations into plant life and made their deductions and formulated their laws upon a working basis of perhaps a dozen plants. Mr. Burbank has used as many as a million plants for a single test, and he has more than once rejected every one of the million, save, perhaps, half-a-dozen, or even less.

When the great mass of plants in a given test is ready for the final scrutiny to see what ones shall be allowed to live, then comes the exercise of the most wonderful faculty of the man. He must go over every one of these plants, be it ten thousand or a million, and select from them such as are fit for use in a continuation of the test. This he does with marvellous rapidity. With aids to bring him the plants, he passes upon them with such rapidity that a hundred thousand may be decided upon in a single day.

If all these plants had to be tested in the usual way, it would cost at least a million dollars. Each would have to be set out by itself, covering a considerable surface of valuable land; each would have to be cultivated and cared for for four or five years; each would need to be grafted. In a single day this one man accomplishes what could be reached otherwise only by years of waiting and by an enormous attendant expense, his masterly judgment, backed by a wonderful intuition, enabling him to accomplish that which indeed seems little short of a miracle.

A friend of Mr. Burbank some years ago, having heard of this wonderful facility, suggested a test. He did not doubt Mr. Burbank's word; but, still, how could such a thing be possible? So several thousand plants—a series of plum seedlings—were selected and turned over to Mr. Burbank in the usual way. As they came before him they were instantly separated into three classes--good, mediocre, and worthless. Then all were planted to decide the matter. When the plants had been growing long enough—several years—they were all tested, and in every instance the result tallied precisely with Mr. Burbank's selection.

Said a friend to him: "How can you tell, among a hundred thousand young fruit trees or flowers or vegetables, those that are fit to live, saving only perhaps a single one out of the whole mass?" The answer came quickly: "You see a face on the street, a thousand faces, ten thousand.

Instantly, as you see each one, without thinking how or why you do it, your mind shows you the difference in those faces—there are no two alike. If you are a shrewd business man, you can tell almost unerringly whether any one of those ten thousand is the one you want. You cannot tell all the details of the life before you, but the general characteristics you may read at a glance. I read these plants as easily as I could read human beings."

Selection means choosing for virility, for fecundity, for beauty, for resistance to disease. In one experiment—the production of the "white blackberry"—Mr. Burbank chose one plant out of sixty-five thousand. All the rest were found wanting, and were burned at the stake; from the single bush came one of his most marvellous creations. Not another one in the sixty-five thousand had so far maintained the course laid out for it by the leader that it could be trusted to itself.

Sometimes it is two plants of the same species that are used. They and their fellows are not so thrifty, not so productive, not so beautiful as he would have them. He sees their imperfections; he sees their possibilities. Here the same process of selection follows year after year, until, at last, the old has given way to the new, and a powerful life has replaced a weak one.

It may have been only a common wild flower at first; now it is a noble bloom. It may have been a wild native fruit, small, sour, acrid, distasteful; now it is a splendid product, with a delicious flavour, a meat rich in nutrition, with a rich colouring. It may have been a tree stunted, slow-growing, virtually worthless; now it is a splendid figure in the forest, growing as much in a decade as its forbears did in a generation.

Or it may be the creation of an entirely new species. It is the primus berry, rightly named, a combination of a raspberry and a blackberry.

Two lines of work are followed:—

1. Cross-pollination, which includes crossing, the mingling of strains within a species; and hybridisation, the breeding together of members of different species.
2. Selection, choosing out such plants as are best adapted to the purposes of the experimenter.

Under the first head Mr. Burbank says:—

"By crossing different species we can form more variations and mutations in half-a-dozen generations than will be developed by ordinary variations in a hundred, or even a thousand generations."

What are the instruments of this great work? In most cases only a watch-crystal, or a small saucer, and the finger-tips with which to take the pollen, which has been dusted upon the crystal, and place it upon the waiting stigma.

For all these untold centuries the plant has been going forward upon an unbroken line; now it is suddenly disturbed, its life-habits are broken up, it receives the most powerful shock nature can give. It is vaster than the shock of death, for it is death swiftly blent in a new life. The new plant sets out upon its journey, never to return to the old ways. Thousands of its kind fall by the way or are ruthlessly put to death.

As the work progresses, results are hastened, whenever practicable, by grafting and budding. The ability of Mr. Burbank to act with tremendous force and rapidity, when needful, was early shown in his work and in this line of grafting. It was in the days when he was struggling to make both

ends meet in carrying on a nursery. He was sadly in need of funds. A rush order came for twenty thousand prune trees. It would take two years and a-half to grow them in the ordinary course of affairs, but he could get the order only by turning them out in nine months. He called in a small army of men and put them to work planting over a hundred thousand almond seeds. The almond grows rapidly. In a few months the young bushes were ready; the best were selected, and twenty thousand prune cuttings were grafted upon them. In nine months the order was filled, and to-day one of the largest prune orchards in the world is growing and yielding from these self-same almond trees.

Some idea of the vastness of Mr. Burbank's work may be obtained from the fact that there are now growing at Sebastopol three hundred thousand distinct varieties of plums, different in foliage, in form of fruit, in shipping, keeping, and canning qualities; sixty thousand peaches and nectarines; from five to six thousand almonds; two thousand cherries; two thousand pears; one thousand grapes; three thousand apples; one thousand two hundred quinces; five thousand walnuts; five thousand chestnuts; from five to six thousand berries; with many thousands of other fruits, flowers, and vegetables, in all cases different from all the others.

Speaking in general of such work as he is carrying on, Mr. Burbank says:—

"In pursuing the study of the universal and everlasting laws of nature, whether relating to the life or growth, structure or movements, of a giant planet or the tiniest plant, or the psychological movements of the human brain, the same conditions are necessary before we can become one of nature's interpreters or the creator of any valuable work for the world. Preconceived notions, dogmas, and all personal prejudice and bias must be laid aside. Listen patiently, quietly, and reverently to the lessons, one by one, which Mother Nature has to teach, shedding light on that which before was mystery, so that all who will may see and know. She conveys her truth only to those who are passive and receptive, accepting truths as suggested, wherever they may lead. Then we have the whole universe in harmony with us."

The obstacles in the way of the accomplishment of Mr. Burbank's life-work have been many and desperately hard to surmount. Lack of funds at critical periods, the enmity and jealousy of those who should have been his staunchest friends, the attempts of men saturated with selfishness to rob him of the fruits of his labours, the failure of costly experiments carried on through long years of patient toil, attempts even upon the part of specialists to take unfair advantages—the list may not here be elaborated. There have been proffers of aid in the past, but they have in large measure been those to which a selfish string was attached. He has set his face like steel against any plan, no matter how tempting, that will take from him one jot or tittle of his independence; to do otherwise would be fatal to the work. Since 1893, when he sold his large and flourishing nursery business that he might thereafter give his entire time to plant-breeding, there has not been a year when he has not run behind in expenses. So he has gone forward all these years, hampered and half-shackled, but every day advancing, if ever so slowly.

The man who has known what it is to feel the cruel pangs of hunger, who has slept in noisome places when he could call no roof his own, who has done the most repugnant and disagreeable labour to earn a pittance to keep

soul and body together, who has fought off fever when he had not money enough to pay for the daily pint of milk which stood between him and possible death, who has steadily denied himself all the minor luxuries of life and many of its comforts; the man who, until a few years ago, never owned a microscope, so important an instrument in his work, and then only a cheap and inadequate one,—this man, who had sacrificed at every possible point and made constant inroads upon his hard-earned savings, after perilously near complete physical breakdown as a result of overwork, and all that he might beautify and glorify and make more habitable the world about him,—this man is as brave a figure as ever went forth to battle.

THE RETTING AND MANUFACTURE OF FLAX.

By H. Wolff.

Having now described all that portion of the work in the industry which every intelligent farmer can be expected to do and carry out without any further assistance, I now come to that half of the work which, although there is nothing wonderful or impossible to the "average" man about it, must be learned by practical experience and careful investigation. I mean, first, *the retting*; and then, in rotation, the breaking, scutching, and marketing of the fibre.

Retting.

The term "retting" means the subjection of the raw flax-straw to moisture, to *rot* to a certain stage. This is either done in water (which, by the way, is the old laborious and objectionable way), by chemical process, or by the action of the dew, rain, and atmosphere, which is a much cheaper, less objectionable, and quite as effective way, and is known as *dew-retting*. To dew-ret flax, the straw is spread out in straight rows, about one inch thick, on a grass or stubble paddock. The more moisture there is in the atmosphere, the sooner will the upper side of the straw turn from its original colour to a dirty grey. From two to four weeks will bring about this effect. When the upper side is deemed to be sufficiently retted, the stuff is turned over by means of a long stick, placed under the *swath*, and the lower side brought to the top and left exposed to the weather for another two or three weeks, as the case may be, when the straw is deemed to be evenly and sufficiently *rotten* or retted. It is bound in big bundles when dry, and taken to the flax mill, ready to be treated. Flax-straw, on account of its woody stem, is very easily dried during any fine or windy day, say, from 11 o'clock until evening. It is quite possible to tie up flax straight from the ground without doing anything towards the process of drying; but should there be wet weather, and the flax is sufficiently retted, it will be necessary to stand the straw up in umbrella-shaped cocks. In that position it will stand a lot of rain without being much damaged; and

the expense is very little greater, as the cocks will dry rapidly on windy or fine days, and can be quickly tied, each cock making a bundly. The question is, When is the straw sufficiently retted? To the experienced man this is readily discernible, and simply tested by taking a small handful of straw when dry, and rubbing same. It is necessary that the fibre, which is the bark, should peel off with great ease from the woody stem. The stem itself breaks readily into fine bits, and the fibre appears soft and pliable. Should the straw be not sufficiently retted, it is hard or quite impossible to separate the fibre from the stems. In a case where the straw is over-retted, both the fibre and stem will break as soon as touched, and be worthless. The man with experience and knowledge will strike the happy medium between the above extremes of too tough or too rotten, and produce good fibre. The softer, finer, and more evenly retted a sample of fibre is, the more valuable it will be; and it is only by careful and repeated experiments that a man can become proficient in the knowledge of flax-retting. But to the careful and energetic manufacturer there is little risk of losing the fibre through over-retting by the dew-retting system. It is otherwise with the water-retting. The straw placed in soft, warm water, will ret in as many days as it takes weeks by dew-retting, and a delay of twenty-four hours or less may mean the loss of the entire quantity in the retting. The same may be said of chemical-retting with even greater certainty; as in the case of hot-water-retting, which only takes 30 hours, the slightest error of judgment may bring disaster.

The retting of the flax-straw could be carried out on the farm, as the work itself is very simple, provided that someone who understands the nature of the process could be consulted from time to time, and advise farmers when the straw is ready for tying up. The retting finished, the straw may be either at once taken to the flax-mill or stacked. It will keep indefinitely when kept dry. Mice or other vermin will not touch it; and, if anything, the fibre will improve in quality when kept in stack for a while.

The Manufacturing.

To produce the flax of commerce there are various systems of manufacturing in vogue among the different people of the earth, the most primitive of all being the beating with a mallet—rubbing, scraping, and combing of the retted straw until all the woody stem has been removed. In this way magnificent flax has been produced in olden times, and even to-day a great deal of flax is made in the above manner among the poor people of Europe, especially Russia. But to compete with the ever-cheapening cotton it was found necessary to invent machines to do the work much quicker, and of course very much cheaper. Many different kinds of machines were tried, with varying success; and by continual improvements we have now arrived at a stage of perfection in the machines, and four persons, working one set of machines, will turn out eight times as much fibre as four persons working by hand only, the fibre being of equal value. The accompanying illustrations, marked "Breaking" and "Scutching," will perhaps give readers a better idea than words could convey about the process. Suffice it to say that the machines shown are made by Lawson & Sons, Leeds, England. The breaker consists, first, of an iron framework, in which are placed two parts of ingeniously fluted iron rollers, placed one pair above the other in such a way that the flutes will grip in each other like spur-wheels; besides all the necessary shafts, pulleys, and spur-wheels for driving the rollers,

first, nine inches round one way, and, by a peculiar action of the wheels, six inches in the opposite way, giving the fluted rollers a forward and backward motion. Handfuls of straw are passed by one operator between the rollers, which, moving at a rapid rate, break and scrape off all the woody stem inside the fibre, which passes after a few seconds to the other side of the machine, where another operator receives the handfuls and passes them on to the next machine, called the scutcher. As may be seen, the scutcher, again, consists of an iron or wooden frame, which carries a shaft. On this shaft five or more wooden or iron boards, called beaters, are securely fixed, somewhat in the manner of spokes on the hub of a wheel. The part of the machine on which the operator is seen holding the handful of flax is called the stock. This stock is movable, and consists of an iron slab, about half-an-inch thick, and is placed so that the beater next to it is parallel to its upper edge, only leaving a space of half-an-inch, more or less, according to the flax operated on, in which to place the handful of flax coming from the breaker. The operator holds the handful tight over the stock with the left hand, the other being employed in turning and opening up the fibre. As each beater strikes downwards along the side of the handful of flax, any short and broken fibre, and all the bits of stem yet adhering, are removed, and in a few seconds the fibre appears perfectly clean, smooth, and straight, and ready for market. The clean fibre is bound in bundles of 20lbs. each, and placed in woolpacks, which will hold about 500lbs. The short and broken fibre removed by the beaters is gathered together and roughly cleaned by shaking, and sold as flax-tow, worth about £5 per ton, or about one-eight the value of the clean fibre. In well-retted raw material the proportion of tow to clean fibre should be as one in six, assuming that the men doing the scutching are experienced hands—beginners will always make more tow, even with the best of raw material. Flax-straw, when too much retted, will make more tow than fibre, or, if not sufficiently retted, the fibre produced may be so coarse and hard as to be almost unfit for spinning.

I have now given a portrait of the production of a marketable fibre, as produced by us in Victoria, for which a ready market can be found at the paying price of from £40 to £45 per ton; first of all, in the Commonwealth, for the manufacture of twines and cordage, of which materials hundreds of thousands of pounds worth are annually sold in the Commonwealth. In addition to our own markets, the markets of Europe are open to us. Inquiries and samples submitted to large spinning mills in both Great Britain and Germany proved that our fibre is equal to 70 per cent. produced in Europe, and used for the manufacture of linen, the average price of which ranges from £40 to £50, the United Kingdom alone importing 56,000 tons annually, principally from Russia. This should show clearly enough that intending flaxgrowers need have no fear of glutting the market with their produce. My opinion is, that it will be many years before the Commonwealth exports flax, because I am assured by our present buyers that, given a sufficient quantity of raw material, there is nothing to prevent them from going in for the manufacture of linen locally. The Customs figures show that the Commonwealth imports over a million pounds worth of linen and linen goods; and this million might be earned by ourselves.

Before closing this article I wish to point out, that although we claim to have found a way to produce a marketable fibre at a price which will leave a handsome profit to the grower, there is yet plenty of room to improve on our methods, and produce the higher qualities of flax-fibre, which are anxiously sought after in Europe. By yet a more careful handling, and the

choosing of the best soils and climate, flax can be produced worth from £60 to £70, and even £150 per ton. The latter price is not unfrequently paid for small quantities produced in Belgium, on the River Lys. This flax has such wonderful qualities of softness, lustre, and strength, that it is used for the manufacture of the choicest lace and other high-priced linen articles. Only it remains for us to find out if we can produce these high qualities of fibre. The soil and climate are the principal factors, and as to these, my honest opinion is, that Tasmania especially possesses these features in a high degree. It now devolves on the farmers and manufacturers to find out what the land will do. The average article can be grown with certainty, and time and further experiments will prove to what extent we can produce the higher-priced article. Higher prices mean greater profits for all. Wherever possible, it will pay individual growers to harvest the crop, and then sell the same to the nearest manufacturer, with the seed still on the straw. A crop delivered at a flax-mill will be worth £5 per acre on an average, a really good crop being worth up to £6 10s. per acre; or, farmers could take off the seed, and sell the straw only to the mill, good average straw being worth £3 per ton.

The flax-mill may be either proprietary or co-operative. The advantage of a large mill lies in the possibility of one practical man managing hundreds of acres. And even the labour, on account of the proficiency constant employment gives the operators, will be less than if individual farmers manufactured their own crops. In any case, the necessity of having to buy a complete plant would not admit growers of less than 50 acres yearly to work with advantage, even assuming the owner has the necessary experience. Co-operative mills will probably prove to be the most convenient way of handling both the seed and fibre in the future. But for the first few years, no doubt, a few enterprising men will take up the industry, and buy any crop grown, either with or without the seed.

To establish the industry it is only necessary that every farmer who looks to the future should try a few acres for the coming season—say, up to 20 acres. I feel confident that a fair trial will convince even the most conservative that flax-growing is at least equally as profitable as any other ordinary farming, and, if nothing else, adds one more product to those already cultivated, with one absolute advantage—that its price is not subject to the ruinous fluctuations of other crops in this country. Having seen Tasmanian lands, and felt its climate, I am convinced of the State's superiority over the mainland, and therefore hope to be one of those who will take up the industry from the manufacturer's point of view, for the benefit of myself and everyone connected with it.

Hints to Flax-growers.

1. Before planting flax for fibre, find out and make up your mind definitely what you will do with your crop when grown—make an agreement with the manufacturer, fixing the price at which you will deliver a crop of a certain height and quality to the mill.

2. See that you get good sound seed, of either the Riga or Belgian variety of flax. Make certain, by previous tests, of the germinating power of the seed, which should be 95 per cent. From 60 to 65 lbs. of seed per acre must be sown to produce good results for both seed and fibre. If the aim is to produce the best of fibre at the expense of the seed yield, up to 100lbs. per acre may be sown on very good land.

3. Plough good and clean land as early as possible. If necessary, plough twice to kill all weeds, and make a fine seed-bed.

4. Sow broadcast. Harrow in the seed not more than one inch deep, by hand or machine, if possible, in the autumn; but in favoured districts spring sowing will do, as the crop will come up and mature in fourteen weeks. When sown see that the surface of the land is as level as it is possible to make it, if you intend to cut the crop with mower or binder. When pulling is intended, any new land which will work up fairly fine will grow very good crops.

5. Remove all objectionable weeds while crop is growing—such as thistles, wild turnips, mustard, and, if possible, docks, etc.

6. Commence harvesting when the leaves fall off the stem, and the greatest portion of the seed bulbs have turned a brownish colour. When cutting or pulling, see that the sheaves are kept nice and straight, and not larger than the smallest sheaf the binder will tie properly. Stook in long rows, and let dry until safe to stack. Never stack flax wet, because, if heated, the fibre will spoil; but rain will not spoil it in the stook.

7. See that all work in connection with the flax-crop is performed with care, and in a conscientious manner, whether the crop is for sale or you intend to work it yourself. Conscientiousness is the acme of success. *Agricultural Gazette*, Tasmania.

THE HORSE.

By A. E. Le Souef, Director of the Zoological Gardens of W.A.

The following interesting article on the Horse, by Mr. Le Souef, cannot fail to be of interest to all horse breeders :—A wonderful light has been let in by geology on the derivation of the horse. Students of geology in pursuit of their study came across the remains of extinct animals of different kinds, and on palæontologists following up the clues thus made available, it was fortunately found that the key to the evolution of the horse was discovered. The earliest known ancestor of the horse is the phenacodus primœvus, which existed in the early eocene period, and which was a small five-toed animal with a long tail like that of a rat, in fact the restorations of this animal more resemble a huge rat than anything else. From its conformation the phenacodus was evidently well adapted for a life in swampy country, its spreading feet and primitive forms of grinding teeth showing this. As time went on some of the descendants of this animal evidently took to a life on drier parts of the country, and became more fitted to escape their enemies by speed in the open than by hiding in the recesses of the swamps. The most marked change that this state of things brought about was that the animals developed the centre toe, which evidently took most of the weight on hard ground, and the other toes being to some extent unused, began to atrophy in proportion as the centre toe developed faster from the extra work to which it was subjected. The development of the centre toe with the consequent

diminishing of the other toes can be traced without a break from the five-toed phenacodus to the one-toed horse of the present day.

The orohippus of the eocene age having four toes the miohippus of the miocene age having three, and the pliohippus of the pliocene age having the one toe, with the two small extra ones only represented by splint bones, as in the present-day horse. The other parts of the skeleton have also undergone change, and have developed to make the horse more suited to his changing conditions of life. In the teeth the changes are very marked; the present-day horse does not need large canine teeth to fight with, so the canines which were well developed in the ancestors of the horse, have, through the ages, become modified until now only the male horse habitually has small canines, while they are nearly always absent in the mare. The grinding teeth, too, have undergone great changes to make them better suited for grinding hard and harsh substances, whilst the number of grinding teeth is now habitually less by four. Even in this age, cases of reversion sometimes occur, in which the horse may have the old number of 44 teeth all told. In such a case, unless there is skilled dental treatment, there is danger of the extra teeth interfering with mastication to such an extent as to starve the horse to death.

The eye-socket has also undergone changes that make for the protection of the eye, as in the old types of horses the eyeball was not protected from injury in such a perfect way as it now is. The gradual development of processes of the malar and squamosal bones to form the zygomatic arch over the top of the eyeball can be clearly traced through the different geological epochs. The diastemma or space between the incisor and grinder teeth, in which the bit is placed, has always existed in very much the same form as at present.

The colours of the ancestors of the horse are now only a matter for conjecture, but it is thought that, very likely, the animals were either spotted or striped, although some hold the opinion that they may have been practically uniform in colour.

The colour of Prjevalsky's horse, which is thought to be one of the two descendants from the early horses that have never been domesticated, is a dun colour, tending to become lighter on the under parts.

The Tarpan, the other wild horse, is usually mouse-coloured, and lighter also on the under parts. Both these varieties have a stripe along the back.

Besides Prjevalsky's horse and the Tarpan, which are both found in Asia, there are other members of the horse family existing that are not so nearly related to the domestic horse. The most striking of these are the zebras, or striped asses, of Africa, of which there are four well-marked species. Then there is the common wild ass of Africa, from which our domestic breeds of donkeys are supposed to have sprung, and also the Somali wild ass, also of Northern Africa. In Asia, there are three varieties of one species, namely, the Kiang, Onager, and Syrian wild asses. Of the zebras, Grevy's is the northern form of the largest, standing up to 15 hands in height. It is heavily striped with narrow black bands, and is a very handsome animal. This species of zebra became known later than the other kinds. The mountain zebra, which is found in the mountain ranges, of South and South-Western Africa, is now getting very rare. It stands about 12 hand high, is very heavily marked with broad black stripes, and seems to have more of the donkey characteristics than the other zebras. This zebra was the first one to be discovered and used to be called the common zebra.

A third species of zebra, the Burchell's zebra, is about 13 to 14 hands in height, and is divided into several varieties. This zebra is being used for breeding the horse zebra hybrids called zebrules. The fourth member of the zebra family, the quagga, is now thought to be extinct. It was about 14 hands in height, and seemed better suited for domestication than any other member of the zebra family. Unfortunately, it had only a restricted range in South Africa, and was thought to be exterminated about 1870. The quagga was of a brown colour, with the head and neck striped with dark brown and white stripes. Of the two varieties of asses found in Africa, the common one is about 13 to 14 hands in height, and of a mouse colour. It has a stripe running down the back and over the shoulders. The Somali wild ass is French grey in colour, and although it is striped on the legs, it has not the shoulder stripe. Of the three kinds of Asiatic wild asses, the Kiang is by far the finest variety. It is light reddish brown in colour, and about 14 hands in height. This would be a valuable animal for mule breeding. The colour of domestic horses varies greatly.

In most horses dapples or spots can be seen in certain lights, whilst in rare cases brindled horses or striped horses are met with. In Iceland the ponies sometimes show stripes on the face and legs, resembling Grevy's zebra, and in India horses are met with showing the stripe down the back and over the shoulders. Owing to domestication, white and conspicuous colours, such as piebald, have become not uncommon. If these horses had to contend in a keen struggle for existence in a wild state they would be likely to be nearly exterminated, owing to being so conspicuous and easily singled out by enemies. It might be mentioned that the apparently conspicuous stripes of the zebras act in such a way as to really render the animal almost invisible to a novice in certain lights. It is said that the Arabs, who have the purest breed of horses to be found in the world, value the colours of horses in about the following order:—Bay with black points, golden chestnut, brown, and grey. There is an old Arab proverb, that a "grey horse melts in the sun like butter and in the rain like salt." This may account for the number of grey horses sent out of Arabia. Dark manes and tails in the Arab horses are said to be a sign of high blood; this especially applies to chestnuts. Constitution is indicated by colour, as experience shows that a horse of say, a hard bay colour, with black points, has correspondingly tough material in his bones and sinews, etc., and will stand work without breaking down better than a horse of the same conformation, but of a washy light colour. Colour in a horse may indicate disposition; for instance, light, washy chestnuts are often irritable and excitable. Albino horses, with pink skin and light-coloured eyes, are not uncommon. Horses are never, or very rarely, born of a white colour unless they are albinos; the foals are grey, and the horse gradually becomes whiter with age. In old white horses melanotic or black tumours in the lymphatic vessels are common, owing to the black pigment not being cleared properly from the system. The mane is upright in the two wild horses and all the zebras and donkeys. In Prjevalsky's horse the mane hangs over a little in the winter, but becomes upright again in the summer. In the domestic race of horses sometimes the mane is so long as to sweep the ground, and when this is fostered in a suitable subject a great length may be attained. The long hair of the tail in the zebras and donkeys is only a switch at the end; in Prjevalsky's horse the tail is like that of a mule, being intermediate in character between that of a donkey and a domestic horse. The chestnuts which are found in the four legs of all domestic breeds are only found on

the forelegs of the Tarpan, and also the zebras and asses; these have only a prenatal use. Some great catastrophe must have killed out the horse in America in a late geological period, as numerous fossil remains have been found in America, and what makes this more difficult to understand is that the horse, when reintroduced into America, throve amazingly well. In Europe the horse was evidently extensively used by man for food in the stone age, and it was also, at an early period, domesticated.

The Arabian horse is the oldest breed of thoroughbred horse now known. He has been carefully bred in Arabia for a saddle-horse since 500 A.D., and, owing to his master's life often depending on his possessing qualities of a high order, he has been for hundreds of years subjected to careful selection and training in qualities that go to make a nearly perfect horse for saddle purposes in the desert. The best Arab horses are courageous, abstemious, good-tempered, and beautiful animals, and there is scarcely a breed of light horses in the world that does not owe much to Arabian blood.

Being bred for all-round excellence, the Arabian horse cannot compete with breeds for special purposes. For instance, the English thoroughbred horse, which owes its origin to Arabian blood, is now head and shoulders over the Arab for speed, whilst English racing ponies can beat Arabs of the same size, both at galloping and jumping, but it is not certain that they would prove superior over an extended trial, where the quality of endurance would be severely tested. The height of the typical Arab is about 14 hands two inches. It is not certain from whence the Arab horse is derived. It may have come from Libya, in Africa, or else Asia. This is an interesting point that may be cleared up by the discovery of further fossils. An artificial English breed that almost invariably throws true to colour and character is the Suffolk Punch. Horses are much affected by environment and feeding. The tiny Shetland ponies that are reduced to eating seaweed in the winter and have a very restricted range, are well known, and also the small ponies found on the islands of the Malay Archipelago, and also the ponies of Iceland, whilst their opposite, the giant Flemish draught horse, that is bred on the rich flat of Flanders, and has been forced in growth by succulent and nutritious feed for generations, may grow to 18 or 19 hands in height. The desert-bred horses are hardy and enduring, and it may be said at once that the hot, dry climate is the most suitable for the horse, providing that the food supply is good in quality. Providing the members of a given family are kept in different environment and conditions, inbreeding is not now thought to be injurious. Small islands generally have small animals, especially horses, as inter-breeding is favoured, whilst the conditions do not admit of change. The horse is essentially a herbivorous animal, but can be taught to vary its diet. It is said that the Tartars give their horses flesh to eat, and in Iceland the ponies will eat fish. Some horses will take readily to boiled meat as a diet, and soup of meat and grain is a very strengthening diet for a horse that will take to it. In large countries the difference of the appearance and capability of horses bred on various soil formations is most marked, and, as one would conjecture, the horses bred on poor sandy country, especially near the coast, have less stamina than those bred on better soil inland. Horses bred on dry ironstone hills have usually great hardiness, and they possess very tough, strong feet. The mountain zebra and some of the wild asses also possess feet of a very enduring quality. Horseshoeing has been invented for a very long time, and many patterns of shoe have been used, from the iron plate covering the whole ground surface of the foot to the shoe of the present day. In parts of Japan straw sandals are used for

the horse, but they quickly wear out. The noises made by members of the horse family are various. Horses neigh to each other to attract attention. They also may squeal with temper. When frightened they sometimes trumpet or blow through the nostrils, and when less frightened they snort. Horses in rare cases scream. The members of the zebra family utter a sound like the yelping of a dog, and the members of the ass family all bray. It is possible to produce hybrids between any members of the horse family, and although these hybrids are nearly always sterile, they are much harder than the pure breeds, and more useful for many purposes. Hybrids between zebras and horses are called zebrules, and between donkeys and horses mules. Experiments that are being made in hybridisation may yield very valuable results.—*West Australian.*

SLEEPY DISEASE OF TOMATOES

(Fusarium lycopersici).

The "Sleepy-Disease" of tomatoes, although known for some seasons, has acquired an increased importance among growers owing to the extended cultivation of the plant in recent years.

The plant may be diseased inside when quite young, but the outward manifestations do not necessarily appear at once. The first indication that the tomato is affected is shown in the drooping of the leaves and their bad colour. If the root is split, the woody portion is seen to be of a dingy yellowish brown colour, which becomes more marked if left open for half a day. When the plant has been attacked about three weeks the lower portion of the stem is usually covered with a delicate white bloom of mildew. Eventually the stem is covered with patches of a dull orange colour and becomes very much decayed. The disease can always be identified by a brownish ring just within the bark at the base of the stem or thicker branches of the root.

The disease is due to a fungus which flourishes in the soil and enters the plant by the root. During its development it passes through three stages, the first of which usually lasts about a week, the stem at the end of that time being much decayed and covered with a gelatinous mass. During the last stage the spores are resting and preparing to attack the young plants another year, or whenever a suitable opportunity presents itself. The plant can only be attacked by the fungus in the last stage of its existence.

Treatment.

1. It must be remembered in the first place that diseased plants never recover, and therefore no attempt to save the plant is successful.

2. As the disease grows inside the plant it is useless to spray with a fungicide.

3. As the resting spores of the fungus live and thrive in the earth and attack the plant through the root the disease must be attacked in that quarter.

It is therefore recommended that:—

1. All diseased plants should be uprooted immediately the disease is noticed, and should be burned.
2. The soil in which the plants grew should be removed and sterilised by heat, or mixed with a liberal allowance of quicklime.
3. If the disease appears in a glass house, every part of the house should be washed with a solution of carbolic acid and water (1 of the acid to 20 parts of water) after the soil has been removed.
4. If it is not practicable to remove the soil, it should receive a liberal dressing of gas-lime. This should be allowed to lie on the surface for 10 days, and should afterwards be thoroughly incorporated with the soil. After this the soil should remain for at least 10 weeks before anything is planted in it. It should be soaked with water once a week.
5. As much lime as the plants will allow should be mixed with the soil in which tomatoes are grown, more especially if they are grown in the same beds during successive seasons.
6. The infected soil from a bed should not be thrown out at random, but should be sterilised by admixture of quicklime, and care should be taken not to bring it in contact with tomato beds.
7. Only short-jointed sturdy plants should be used, and those should be fairly hard and the foliage of a dark bronze appearance. All spindly or drawn plants should be rejected.
8. The plants should be allowed plenty of air, light, and room for growth.—*Board of Agriculture, Leaflet No. 116.*

ECONOMY IN STOCK MANAGEMENT.

In the interesting paper on the breeding, rearing, and fattening of live stock, which Mr. Sanders Spencer read at a recent meeting of the Hunts Chamber of Agriculture, several points of the highest importance were touched upon. With an experience of 40 years or more to draw upon (says an English paper), Mr. Spencer is well entitled to a respectful hearing on a subject of this kind, and his remarks, expressed in moderate and deferential terms, borne of long experience, are worthy of more than passing notice. It is characteristic of men trained in the school of practical experience that

they observe moderation and toleration in everything they say connected with the management of farming affairs, and, accordingly, although they do not forcibly urge the adoption of their views, it is generally safe to assume that what they suggest are the methods that have been found to have best withstood the test of time, and are likely to produce the best results in years to come. Changing circumstances, of course, may justify certain modifications in detail, but the underlying principles can vary little, and so we may take it that what Mr. Spencer and others of similar experience advise is always worthy of being treated with the greatest respect. Mr. Spencer at the outset imparts sound advice concerning the risk incurred by those who, in comparative ignorance of the local conditions, hastily proceed to introduce therein practices and customs pursued in other parts of the country. In these days, when farmers are less restricted to geographical areas than was usual in former times, this note of warning is especially opportune. Undoubtedly the best course for a farmer new to a district to adopt is to follow the system pursued by the best old farmer in the neighbourhood, and to modify it as subsequent events may suggest. Hundreds of farmers who have migrated to new districts will readily bear testimony to the soundness of this counsel.

Mr. Spencer is particularly interesting in his remarks bearing upon the breeding and management of live stock. He admits, of course, that there are circumstances in which it is impracticable for the farmer to breed and rear cattle or any other class of stock, with the possible exception of pigs, but where breeding as well as fattening is practicable he strongly advocates the adoption of the system of breeding and rearing as many as possible of the animals that the farm is capable of fattening. He urges the adoption of this method for various reasons. In the first place, the farmer who breeds his own stock is in a better position to know exactly what to expect of his animals. If he manages his affairs with moderate prudence, he breeds the class of animal that will give the best return for the food it consumes, while having it under his personal supervision from the day it is born until its brief career—and the briefer the better for his pocket—on the farm is ended, is also a favourable omen. The importance of this point cannot easily be overestimated. The farmer who is compelled to buy his store cattle is largely at the mercy of circumstances. He may be fortunate enough at times to procure responsive animals, but oftener than otherwise it may fall to his lot to obtain stock which, underbred to begin with, have been badly managed in the rearing, and which accordingly are ill-fitted to give a profitable return for the food they consume. Live stock seldom recover from the effects of starvation at an early stage in their career, and although the farmer who fattens them is less likely to lose by them than those through whose hands they pass before reaching him, yet they never can yield quite such satisfactory results as stock whose progress has been continuous.

Becoming comment is also made upon the waste which is inevitably incurred in the case of animals that frequently change hands. For example, a large proportion of the ordinary store cattle of the country may have changed ownership two or three times before they come into the possession of the farmer who finally prepares them for the butcher, and in the case of such animals Mr. Spencer estimates that at least £1 per head, or, say, 5 per cent., on the ultimate value of the animal, is sacrificed in the course of its circuitous wanderings.

GARDEN NOTES FOR SEPTEMBER.

By Percy G. Wicken.

This being the spring month, the temperature of the soil begins to increase and plants begin to make growth. Almost all kinds of summer vegetables can be planted with safety, and the month is consequently a busy one for those engaged in gardening. Whether carried on as a pastime or as a means of making a living, gardening, either for flowers or vegetables, requires constant care and attention as well as a certain amount of what is termed by the amateur gardener "healthy exercise," and by the professional "hard work." The ground must be kept free from weeds, the surface well stirred to conserve the moisture, the unsown portions well dug up and sweetened, and a constant look-out kept for grubs and other insect enemies. All these operations keep one occupied, and, as the drier weather comes on, watering must be added to the other duties; but by the time this is necessary the days are becoming longer, and out-door work more congenial than at the present time, and the improved appearance due to the display of flowers or the succulent vegetables amply repay one for the labour given. Most of the more tender and delicate plants may be planted in the open this month, and seed beds may be made in the open for tomatoes and such like plants, while in our earlier districts these plants will be growing rapidly. All plants raised in early seed beds should be planted out as soon as danger from frost is over. Any ground proposed to be used for summer crops should be thoroughly broken up as deeply as possible. In the event of dry weather, those plants which are able to send their roots deeply into the ground are best able to flourish, and in a deeply-worked soil the roots will go deeper than a shallow-worked one. Where only a small area has to be worked it will pay to have the land trenched; but the surface soil should be kept on top, and the subsoil should not be brought to the surface, but only broken up and replaced, and well mixed with stable manure. Bone-dust, blood manure, etc., should be dug lightly into the soil and well mixed with the surface soil; while the more soluble manures, such as superphosphates and sulphate of ammonia, should be used as a top-dressing on the surface when the plants are up and able to make use of the same. Insect pests, caterpillars, and grubs will no doubt be troublesome, and as a check for these there is no better mixture than Paris green and water in the proportion of 1oz. of Paris green to 10 galls. of water. Mix the Paris green into a paste first and then add the water. Remember that Paris green is an arsenical poison and must not be applied to vegetables within two or three weeks of the time they are fit for consumption.

Asparagus.—If not already planted out, it should be done at once. The crowns should be planted in well drained land that has been previously trenched and well mixed with farmyard manure.

Artichokes (Jerusalem).—Should be planted out this month, the tubers should be divided into small pieces and planted out same as potatoes. They are hardy, will grow on sandy soil and stand a fair amount of drought, while the crop is valuable both as a vegetable and as a food for stock.

Arrowroot (Canna Edulis) is of the same tribe as the Canna; it is well worth cultivating; the leaf has a handsome appearance in a garden, while the tuber yields well and affords good food for pigs, or arrowroot can be made from the bulbs with very little trouble.

Beans (French or Kidney) are one of our most popular summer vegetables, they should be sown largely in almost all parts of the State. The ground should be well worked, and manures containing phosphoric acid and potash applied. The seeds should be sown in drills three feet apart and one foot apart in the rows. The Butter bean and Wax bean are some of the best varieties to grow, they are less stringy than some of the others.

Beet (Red).—A few rows should be sown to keep up a supply. The seed can be soaked before planting and will then germinate quickly.

Beet (Silver).—A good supply of this plant should be sown, it will furnish a supply of green vegetable during the driest weather. Manure the ground well and sow in rows three feet apart.

Cabbage.—Plant out any young plants that may be available and give them a supply of liquid nitrogenous manure (1oz. of sulphate of ammonia or nitrate of soda dissolved in a gallon of water) to help them along.

Carrot.—A few more rows may be sown, the ground should be dug deeply and manured some time before the crop is sown; sow in drills two feet apart and about four to six inches apart in the rows.

Celery.—Plant out all well grown plants that are available and earth up those more forward. In moist localities a little more seed may be sown.

Cucumbers.—In most parts seed may be sown in the open this month and young plants raised in beds may be planted out; if, however, there is any danger of frost, the plants must be covered at night; a few bushes will answer the purpose. The plants or seeds should be planted on hills slightly raised above the surface, and the soil deeply worked and mixed with stable manure. The hills should be from six to eight feet apart each way, and from six to eight seeds should be planted in each hill. These can be thinned out to four plants later on.

Leeks.—A few seeds may be sown to keep up a supply for future use.

Lettuce.—Seed should be sown in drills in moist situations and thinned out as soon as they come up.

Onions.—Plant out all strong seedlings from seed bed into well worked land and keep beds free from weeds. A little seed may be sown for garden purposes.

Melons.—Rock, water, and preserving melons can all be sown largely during September. The seeds should be planted on hills about 12 feet apart each way, according to the growth of the variety, and about four plants left in each hill. The hills should be deeply worked, as the roots penetrate well down into the soil. Water and preserving melons should not be planted near to each other. They are likely to cross-fertilise and both plants are useless. A little superphosphate should be worked into each hill.

Peas.—In cooler localities a few rows of the quickest growing varieties may be sown. The vines that have commenced to run will require to be staked.

Potatoes.—In most places the crop of potatoes has now been sown, but there are many localities in the South-west where planting can be carried

out in swamp land at intervals all through the summer; in drier localities the time for sowing a crop likely to be successful has passed. Potatoes require to be well manured with a fertiliser containing all the ingredients necessary for plant food.

Pumpkins and Squashes should be sown and treated in the same manner as melons. There are both bush and running varieties; the bush varieties may be sown closer together, as they do not take up so much space and they are also earlier in coming to maturity. The earliest of all are the "white bush" marrow and the "custard squash."

Sweet Potatoes.—If placed in seed beds as described last month there should be plenty of shoots now available for planting out. These should be planted out on ridges; the ridges should be three feet apart and the shoots can be planted 18 inches apart in the ridges.

Tomatoes.—In the warmer districts the plants will be well forward, while in the more southern parts the young plants will only be fit to transplant. As many plants as possible should be put out, as, although tomatoes may be cheap, there is always a demand for first-class smooth-skinned fruit, and a liberal supply for home use is always welcome.

Farm.—Fallowing in the drier districts will be almost completed, but further south, where the wet has prevented the teams from getting on to the land, the teams will be able to continue working for some time, and if the work is not completed by the time the ground gets hard, most of the lighter ground can be ploughed in the summer by the aid of the modern disc plough. It is a pity to see such large areas of fallow ground lying idle when it could be used for the purpose of growing catch crops, such as rape, mustard, kale, etc., and made to fatten a number of sheep, as well as considerably improve the ground for the following crop.

Land should be prepared for sowing summer crops, most of which can be sown this month, and are valuable for providing food for the stock on the farm. Pumpkins, melons, buckwheat, sunflowers, mangels, sugar beets, maize, sorghum, Hungarian millet, French millet, and chicory can all be sown this month, especially in the cooler localities. All these summer crops should be planted in drills from 30 to 36 inches apart, so that the cultivator can be kept constantly going between them. Very little use is made of the horse hoe in this State, it is invaluable for the raising of summer crops and should find a place on every farm. Under the Bush Fires Act burning off has to cease in the Eastern districts on 1st October, and further south a month later, consequently as much burning off as possible should be done before that time so that the land may be turned up and sweetened as much as possible during the summer.

At the latter end of the month the hay harvest will be at hand in the earliest districts, consequently the harvesting machinery should be overhauled and duplicate parts obtained so that no delay may occur when required for use.

LOCAL MARKETS' REPORTS.

MESSRS. ELDER, SHENTON & CO. (LTD.), REPORT.

Messrs. Elder, Shenton & Co., Ltd., Eastern Districts monthly stock report for July, 1905, reads as follows :—

With fair, seasonable weather in the country a firm demand for all classes of stock exists, but many buyers are disinclined to operate at the present high price of stores.

Sheep.—Fat sheep are worth 6d. per lb. at the moment. Forward wethers, with good skins, 17s. to 19s. Good local hoggets up to 17s.; ewes and lambs (90 per cent.), 25s.; lambs thrown in.

Lambs.—Various private sales are reported at irregular prices. Prime lambs, August delivery, should command 13s. 6d. to 14s.; September delivery, 12s. to 12s. 6d. No doubt the satisfactory returns by auction last season will induce most farmers to adopt this means of disposal.

Cattle are still entirely neglected. The number of cattle in the Eastern Districts is steadily being reduced and no stocking inquiry of any kind is noticeable.

Pigs.—Prime bacon pigs are worth 4d. per lb. at Northam; porkers, 5d. to 5½d. per lb.; stores, 18s. to 22s.; slips, 14s. to 16s.; weaners, 7s. 6d. Northam appears to be gaining command of the pork trade in the Eastern Districts, and quotations at that market may be accepted as the standard of value.

Horses.—Very few good sorts are offering, and for the usual rough and worn sorts the demand is listless and prices low and irregular. Good, stout farm sorts, sound and young, may be quoted at £35 to £45 (heavier sorts not inquired for); active mediums, £25 to £33; light sorts, £5 to £15 according to quality.

Hay and Chaff.—Supplies are light, and prime chaff is worth £4 15s. on rails, Northam, f.a.q., £4 10s. to £4 12s. 6d.

MESSRS. H. J. WIGMORE'S & CO'S REPORT.

Chaff.—In connection with our daily auction sales of chaff in Perth and Fremantle, we have to submit the following report for month ending 8th inst.:—Supplies during the month have been fully maintained, an average of about 90 trucks per week having come forward, but despite this fact we have to report, as we have predicted all along, a distinct increase in values, £5 7s. 6d. having been realised in several instances for prime wheaten. We have handled by far the greater portion of the supplies coming in to Perth market, and have had a very heavy task, during the latter end of the month, in endeavouring to keep the market up, on account of the comparatively heavy yardings which have occurred, but we are pleased to advise that we have been successful, as can be seen from the above. We are satisfied that chaff has not yet reached its highest altar, and we shall be surprised indeed if £5 10s. to £5 15s. is not obtained readily before the new season commences. We have still about three months to go, and stored chaff in Perth has now been practically cleared out, while our advices from farmers residing in various districts go to show that chaff is not plentiful; and this is borne out by the fact that many country centres have been drawing their supplies from Perth, and Bunbury also has been drawing freely from Northam. During the month auctioneers have had much trouble owing to the large quantity of

damaged chaff arriving, and in many instances buyers will not bid unless we guarantee every bag in the trucks, which we are forced to do. Goldfields prices remain firm in the vicinity of £6 5s. for prime wheaten, and we look for a steady demand from there for some time to come. The Fremantle market has also remained very firm during the month, and we have sold f.a.q. chaff up to £5 7s. 6d. We do not advise consignments to Fremantle, however, as the market is very erratic, and if it is necessary can always be fed from Perth. We quote closing values as follow :—Prime green wheaten, £5 7s. 6d. to £5 10s.; f.a.q. wheaten, £5 2s. 6d. to £5 5s.; good medium wheaten, £4 15s. to £5; medium wheaten, £4 10s.; inferior sorts, according to quality and condition; prime oaten, £5; f.a.q. oaten, £4 15s. to £4 17s. 6d.; medium and inferior oaten, from £4 upwards.

Wheat.—Has now just about reached Adelaide and Melbourne equivalent, and is exceedingly scarce at the present moment. We sold over 500 bags last week on the basis of 4s. on rails Fremantle, and in one instance secured up to 4s. 1d., but 4s. may be considered as the ruling market value at the moment. Wheat cannot go much higher, unless t'other side wheat rises accordingly, and already enquiries have been introduced into the Adelaide market, and probably shipments will be made from that port before very long. We invite correspondence from farmers and others holding, as we are in a splendid position to make large private sales.

Straw.—We have very little business to report. Price remains at about £2 10s. on rails Perth or Fremantle, and yesterday a truck was sold in Perth at this price.

Hay.—We have no business to record.

Bran Bags.—Are still firm, and we have sold largely during the month. We shall be pleased to quote farmers and others requiring.

Flour.—We have still no change to record in prices. Thomas' Standard Sacks, £8 7s. 6d.; on rails Northam, quarters, £8 12s. 6d. F.o.b. Port Adelaide, Thomas' Sacks, £7 12s. 6d.; quarters, £7 17s. 6d.; at which price we have made considerable sales, and are pleased to report a lively demand for Thomas' Adelaide and Northam Standard.

Algerian Oats.—Considerable excitement has prevailed during the month, and large sales have been made from Melbourne for shipment by cheap steamer "Kanowna," which is due here next week. Our own sales by this steamer amount to nearly 7,000 bags. Present spot prices are: Whole, 2s. 4½d.; Crushed, 2s. 6d.; and we also sold heavily at these prices during last week.

Stout Oats are worth 3s. 2½d., Whole; 3s. 4d., Crushed, on rails Fremantle.

Bran and Pollard.—Stocks at Northam continue very light, and we quote on behalf of Messrs. Thomas & Co., subject to sales, Bran, £6 on rails Northam; Pollard, £6 5s.

THE CLIMATE OF WESTERN AUSTRALIA DURING JULY, 1905.

The weather has been of the usual winter type, a succession of storms passing eastward along the ocean south of the Leeuwin, varied by periods of high pressure and fine, bright, delightful weather. The first third portion of the month was very stormy, but thence onward it was mostly fine, with occasional showers, finishing with stormy conditions on the 30th and 31st.

The rainfall was mostly confined to west and south-west coastal districts from Shark Bay southward, where the fall was somewhat in excess of the average. Elsewhere it was light, and mostly below the mean for previous years.

Pressure was generally about normal, and so was the temperature in all coastal districts, but inland it was hotter than usual during the day and colder at night. Frosts were as usual experienced, especially inland, during the fine weather, and the following table shows the mean and absolute lowest readings of a minimum thermometer placed on the surface of the ground:—

Station.	Mean.	Lowest.	Date.
Peak Hill	36·0	29·0	3
Cue	38·2	31·0	11
Coolgardie	33·7	24·2	13
Southern Cross	33·0	25·4	23
Walebing	31·6	23·0	22
York	33·0	24·0	26
Perth Observatory	43·4	34·5	9
Wandering	30·9	24·0	13
Bridgetown	35·9	28·4	14
Narrogin	37·3	28·5	13
Karridale	42·2	30·4	14
Katanning	37·2	29·0	26
Mount Barker	37·8	29·0	26

The Climate of Western Australia during July, 1905.

	Locality.	Barometer (corrected and reduced to sea-level). Mean of 9 a.m. and 3 p.m.	Barometer: Average for previous years.	Barometer: Highest for Month.	Barometer: Lowest for Month.	Shade Temperatures. July, 1905. Mean Max.	July, 1905. Mean Min.	July, 1905. Mean of Month.	July, 1905. Highest Max.	July, 1905. Lowest Min.	Average for previous Years. Mean Max.	Average: Mean Min.	Average: Highest ever recorded.	Average: Lowest ever recorded.	Rainfall. Points (100 to inch) in Month.	Rainfall: Wet Days.	Rainfall: Total Points since Jan. 1.
NORTH-WEST AND NORTH COAST:	Wyndham	30·060	30·032	30·237	29·875	85·5	67·0	76·2	92·6	56·6	85·0	64·9	94·8	50·0	*Nil*	...	1,080
	Derby	30·062	30·038	30·249	29·811	84·5	58·1	71·3	91·3	45·4	84·7	57·8	94·0	42·0	38	1	1,405
	Broome	30·066	30·034	30·241	29·918	81·3	58·1	69·7	87·0	45·0	81·0	57·6	92·5	40·2	25	1	557
	Condon	30·109	30·085	30·294	29·905	76·0	51·8	63·9	83·4	40·0	76·2	50·0	88·8	38·0	39	1	576
	Cossack	30·112	30·096	30·305	29·922	76·4	53·2	64·8	86·0	45·0	74·5	54·9	92·0	43·7	2	1	763
	Onslow	30·125	30·086	30·322	29·916	76·9	49·0	63·0	86·0	40·0	75·4	52·3	88·0	40·1	12	1	584
	Winning Pool ...	...	...	...	...	...	...	...	...	...	...	...	...	...	53	3	814
	Carnarvon	...	30·077	30·400	29·900	67·5	51·0	59·2	75·5	46·4	71·2	49·7	86·0	40·5	27	3	960
	Hamelin Pool... ...	30·130	30·144	30·420	29·880	68·0	46·0	57·0	74·0	37·0	68·9	48·0	77·2	35·6	110	6	749
	Geraldton	30·158	30·161	30·494	29·673	69·0	49·6	59·3	78·5	39·0	68·7	49·7	81·0	34·9	447	12	1,400
INLAND:	Hall's Creek	...	30·114	30·389	29·924	82·7	48·0	65·4	92·5	34·0	78·3	47·9	92·0	35·0	*Nil*	...	488
	Marble Bar	...	...	...	...	78·0	51·9	65·0	88·0	40·0	77·1	52·4	87·0	38·0	20	2	815
	Nullagine	30·152	30·136	30·417	29·979	75·0	...	...	83·2	...	71·7	45·0	82·0	28·9	2	1	468
	Peak Hill	...	30·174	30·550	29·740	67·0	44·0	55·5	76·0	39·0	63·4	43·7	78·3	34·0	63	4	442
	Wiluna *	30·191	30·190	30·510	...	66·0	...	...	75·2	...	62·6	40·2	77·4	28·9	32	3	523
	Cue	30·218	30·184	30·520	29·747	64·9	42·3	53·6	72·4	36·0	65·0	44·1	78·2	33·2	61	5	599
	Murgoo	...	...	...	...	62·9	40·5	56·7	74·6	34·9	...	...	...	...	76	7	413
	Yalgoo	30·184	30·171	30·529	29·660	65·9	40·5	53·7	74·1	36·0	64·4	42·2	78·0	30·7	131	6	621
	Lawlers	30·208	30·197	30·541	29·628	65·2	40·7	53·0	72·3	34·0	62·8	41·4	78·0	31·4	74	6	631
	Laverton	30·221	30·184	30·568	29·612	64·2	37·5	50·8	71·0	29·5	61·6	39·8	76·6	29·0	37	3	642
	Menzies	30·196	30·200	30·546	29·618	63·5	40·4	52·0	71·3	33·3	61·8	42·0	77·0	31·2	128	4	463
	Kanowna	...	...	...	...	62·4	38·1	50·2	70·9	30·2	...	...	...	...	48	4	406
	Kalgoorlie	30·188	30·192	30·547	29·539	63·3	40·0	51·6	72·2	33·6	61·7	42·5	76·2	31·7	36	6	392
	Coolgardie	30·181	30·180	30·538	29·539	63·1	40·0	51·6	71·2	32·9	61·2	41·5	75·3	31·7	29	5	460
	Southern Cross ...	30·182	30·173	30·568	29·609	63·8	36·8	50·3	69·8	27·5	61·9	38·7	79·0	27·0	97	3	436
	Kellerberrin	...	...	...	...	...	...	...	...	...	...	...	...	...	201	10	738
	Walebing *	...	...	...	...	61·5	39·1	50·3	72·0	30·0	59·4	39·6	69·9	28·2	455	17	1,302
	Northam	...	...	...	...	62·2	38·0	50·1	72·0	29·8	60·9	40·0	70·1	30·2	452	16	1,192
	York	30·185	30·165	30·540	29·480	62·0	38·0	50·0	71·0	29·0	62·3	40·6	71·2	27·6	500	14	1,354
	Guildford	...	...	...	...	64·1	44·4	54·2	73·0	36·4	62·8	43·2	72·0	31·5	777	17	2,216

* Averages for three years only.

The Climate of Western Australia during July, 1905—*continued.*

Locality.	Barometer (corrected and reduced to sea-level). Mean of 9 a.m. and 3 p.m.	Average for previous years.	Highest for Month.	Lowest for Month.	Shade Temperatures. July, 1905. Mean Max.	Mean Min.	Mean of Month.	Highest Max.	Lowest Min.	Average for previous Years. Mean Max.	Mean Min.	Highest ever recorded.	Lowest ever recorded.	Rainfall. Points (100 to inch) in Month.	Wet Days.	Total Points since Jan. 1.
South-West and South Coast:																
Perth Gardens	30·002	30·146	30·570	29·458	63·0	47·2	55·1	72·4	39·9	63·2	45·9	72·6	35·0	681	16	2,182
Perth Observatory ...	30·157	30·149	30·569	29·449	63·2	47·2	55·2	73·7	39·4	62·7	47·5	73·8	38·1	683	19	2,232
Fremantle	30·168	30·132	30·538	29·512	63·5	50·5	57·0	73·0	42·5	62·8	50·4	72·2	41·0	474	17	1,594
Rottnest	30·145	30·120	30·504	29·486	62·1	52·3	57·2	70·0	44·6	62·2	52·9	69·2	40·4	504	16	1,694
Mandurah	...	...	...	...	62·7	45·3	54·0	70·3	34·7	62·1	44·8	68·4	31·3	886	16	2,681
Marradong	...	...	...	...	...	...	...	...	...	...	...	...	...	631	15	2,045
Wandering	...	...	...	...	61·8	40·5	51·2	68·0	32·0	...	...	...	...	620	15	1,877
Narrogin	...	...	...	...	57·0	41·2	49·1	65·7	34·6	...	...	...	...	411	14	1,585
Collie	...	...	...	...	60·0	37·1	48·6	68·0	29·3	58·8	36·1	68 0	26·9	732	19	2,420
Donnybrook	...	...	...	...	60·9	40·5	50·7	69·9	33·4	60·3	41·2	66·7	30·6	677	20	2,679
Bunbury	30·138	30·134	30·477	29·449	61·8	46·7	54·2	67·0	38·0	62·9	46·5	72·2	35·9	754	20	2,364
Busselton	...	...	...	...	60·9	43·7	52·3	66·0	35·4	60·6	44·1	66·5	32·5	559	22	1,914
Cape Naturaliste ...	30·084	...	30·450	29·416	59·7	50·2	55·0	66·8	40·0	...	...	...	...	641	23	1,989
Bridgetown	...	...	...	...	60·6	39·1	49·8	68·9	32·4	59·2	38·0	68·3	25·9	465	20	1,913
Karridale	30·055	30·104	30·425	29·388	61·4	47·5	54·4	69·0	35·4	61·0	46·5	70·8	30·6	694	26	3,078
Cape Leeuwin	30·052	30·056	30·382	29·152	60·9	53·9	57·4	68·5	45·7	61·2	52·5	70·6	43·0	662	25	2,608
Katanning	30·134	30·136	30·472	29·395	59·0	41·3	50·2	66·0	32·0	58·5	40·0	68·2	27·0	311	10	1,285
Mt. Barker	...	...	...	...	57·8	41·2	49·2	62·7	33·8	...	...	...	...	180	16	1,508
Albany	30·072	30·087	30·446	29·278	60·9	45·3	53·1	68·8	35·8	61·0	44·6	73·5	33·5	306	21	1,879
Breaksea...	30·070	30·073	30·473	29·125	59·1	49·3	54·2	69·5	41·0	59·5	49·3	71·8	40·0	292	24	1,925
Esperance	30·102	30·130	30·512	29·371	61·0	44·6	52·8	70·2	36·8	62·7	45·1	77·6	33·0	122	10	1,609
Balladonia	30·185	30·188	30·514	29·463	63·0	...	...	73·1	...	60·6	39·5	76·5	26·2	9	3	695
Eyre	30·147	30·172	30·478	29·460	64·8	40·1	52·4	75·0	28·0	61·8	41·6	78·1	27·2	35	5	464
INTERSTATE.																
Perth	30·160	30·149	30·569	29·449	63·2	47·2	55·2	73·7	39·4	62·7	47·5	73·8	38·1	683	19	2,232
Adelaide	30·158	30·168	30·493	29·460	58·0	45·0	51·5	66·0	36·3	58·7	44·3	72·5	32·7	347	19	1,632
Melbourne	30·049	30·025	30·406	29·300	54·8	43·0	48·9	62·9	35·0	55·5	41·4	68·4	27·0	328	10	1,685
Sydney	30·100	30·115	30·390	29·700	59·0	44·0	52·0	70·0	39·0	58·9	45·7	74·9	35·9	26	2	2,600

* Averages for three years only.

The Observatory, Perth, 9th August, 1905.

W. E. COOKE, Government Astronomer.

RAINFALL for June, 1905 (completed as far as possible), and for July, 1905 (principally from Telegraphic Reports).

Stations.	June. No. of points. 100 = 1in.	June. No. of wet days.	July. No. of points. 100 = 1in.	July. No. of wet days.
East Kimberley				
Wyndham	Nil	...	Nil	...
6-Mile	Nil	...	...	...
The Stud Station	...	...	...	...
Carlton	Nil	...	...	...
Denham	...	...	...	...
Rosewood Downs	Nil	...	...	...
Argyle Downs	...	...	...	...
Lisadell	...	...	..	...
Turkey Creek	Nil	...	Nil	...
Ord River	...	...	...	...
Alice Downs	Nil	...	...	...
Hall's Creek	Nil	...	Nil	..
Nicholson Plains	...	...	...	...
Flora Valley	Nil	...	...	...
Ruby Plains	...	...	...	...
Denison Downs	...	...	...	...
West Kimberley:				
Obagama	Nil	...	...	...
Beagle Bay	76	1	...	...
Pt. Torment	74	1	...	...
Derby	62	1	38	1
Yeeda	45	1	...	...
Liveringa	...	...	...	...
Mt. Anderson	...	...	...	...
Leopold Downs	...	...	...	...
Fitzroy Crossing	Nil	...	Nil	...
Fitzroy (C. Blythe)	8	1	...	...
Quanbun	Nil	...	...	...
Nookanbah	...	...	...	...
Broome	46	1	25	1
Roebuck Downs	63	1	...	...
Thangoo	...	...	...	...
La Grange Bay	31	2	40	2
North-West:				
Wallal	147	2	43	1
Condon	91	1	39	1
Pardoo	103	1	...	...
DeGrey River	51	1	...	...

Stations.	June. No. of points. 100 = 1in.	June. No. of wet days.	July. No. of points. 100 = 1in.	July. No. of wet days.
North-West—*cont.*				
Port Hedland	24	2	25	1
Boodarie	32	2	...	...
Warralong	73	1	...	...
Muccan	...	...	...	...
Ettrick	74	1	...	...
Mulgie	62	1	...	...
Eel Creek	...	...	...	...
Station Peak	51	2	...	...
Coongon	75	1	...	...
Warrawagine	160	1	...	...
Bamboo Creek	83	1	25	1
Marble Bar	27	2	20	2
Warrawoona	28	1	14	1
Corunna Downs	18	2	...	...
Nullagine	45	1	2	1
Mt. Edgar	...	...	...	...
Kerdiadary	42	2	...	...
Roy Hill	...	...	...	...
Middle Creek	36	1	...	...
Mosquito Creek	...	...	...	...
Mulga Downs	25	2	...	...
Woodstock	...	...	...	...
Mt. Florence	...	...	...	...
Tambrey	39	2	...	...
Millstream	...	...	...	...
Yandyarra	...	...	...	...
Mallina	50	1	...	...
Whim Creek	58	1	..	...
Cooyapooya	71	2	...	...
Woodbrooke	71	3	...	...
Croydon	36	2	...	...
Balla Balla	...	...	...	...
Roebourne	93	2	1	1
Cossack	111	3	2	1
Sherlock	50	1	...	...
Fortescue	63	3	Nil	...
Mardie	...	...	...	...
Mt. Stewart	...	...	...	...
Yarraloola	...	...	...	...
Chinginarra	...	...	...	...
Onslow	9	2	12	1
Peedamullah	...	...	...	...
Red Hill	Nil	...	...	...
Mt. Mortimer	Nil	...	...	...
Peake Station	...	...	...	...
Wogoola	...	...	...	...

RAINFALL—*continued.*

Stations.	June. No. of points. 100 = 1in.	June. No. of wet days.	July. No. of points. 100 = 1in.	July. No. of wet days.
NORTH-WEST—*cont.*				
Nanutarra ...	...	...	...	...
Yanrey	...	...	...	...
Point Cloates ...	...	...	...	...
Edmunds ...	...	...	...	...
GASCOYNE:				
Winning Pool ...	5	1	53	3
Coordalia ...	...	...	...	...
Towara	5	1	...	...
Ullawarra ...	Nil	...	...	...
Maroonah ...	...	...	...	...
Gifford Creek ...	...	...	...	...
Thomas Police Station	48	1	...	...
Bangemall ...	13	1	...	...
Mt. Augustus ...	...	...	...	...
Minnie Creek ...	29	1	...	...
Yanyeareddy ...	...	...	...	...
Williambury ...	29	1	...	...
Booloogooroo ...	...	...	...	...
Wandagee ...	...	...	...	...
Bernier Island ...	...	...	...	...
Boolathana ...	68	2	...	...
Carnarvon ...	101	2	27	3
Brick House ...	65	2	...	...
Doorawarrah ...	92	2	...	...
Bintholya ...	...	...	...	...
Mungarrah ...	66	1	...	...
Clifton Downs ...	...	...	...	..
Dairy Creek ...	55	2	...	...
Upper Clifton Downs	...	...	...	...
Dirk Hartog Island	...	...	...	...
Sharks Bay ...	65	2	117	6
Kararang ...	85	4	...	...
Meedo	100	2	...	...
Tamala	118	5	...	...
Wooramel ...	111	2	66	...
Hamelin Pool ...	81	3	76	5
Byro	...	...	...	...
Yarra Yarra ...	46	3	...	...
Berringarra ...	59	2	...	...
Mt. Gould ...	...	...	...	...
Moorarie ...	18	2	...	...
Wandary ...	22	2	...	...
Peak Hill ...	4	1	63	4

Stations.	June. No. of points. 100 = 1in.	June. No. of wet days.	July. No. of points. 100 = 1in.	July. No. of wet days.
GASCOYNE—*contd.*				
Mt. Fraser ...	...	...	...	...
Abbotts	Nil	...	12	1
Belele	44	2	...	...
Mileura	31	2	...	...
Milly Milly ...	30	2	...	...
Manfred ...	...	...	...	...
New Forest ...	57	2	...	...
Woogorong ...	...	...	...	...
Boolardy ...	42	2	...	...
Twin Peaks ...	36	2	...	...
Billabalong ...	...	...	...	...
Wooleane ...	48	2	...	...
Woolgorong ...	39	3	...	...
Murgoo	43	2	76	7
Yallalonga ...	27	3	...	...
Meka	59	2	...	...
Mt. Wittenoom ...	59	2	...	...
Nannine	Nil	...	18	1
Star of the East...	Nil	...	15	1
Annean	3	1	...	...
Tuckanarrra ...	...	...	91	3
Coodardy ...	28	2	65	2
Cue	31	3	61	5
Day Dawn ...	20	3	72	5
Lake Austin ...	41	2	63	3
Lennonville ...	35	3	79	7
Mt. Magnet ...	27	3	83	7
Challa	42	3	...	...
Youeragabbie ...	29	3	89	4
Black Range ...	Nil	...	36	1
Murrum	37	2	43	4
Burnerbinmah ...	21	3	...	...
Barnong	48	4	223	9
Mellenbye ...	35	6	...	...
Yalgoo	35	3	131	6
Wagga Wagga ...	43	3	...	...
Gabyon	41	3	149	5
Tallyrang ...	27	2	194	7
Gullewa	32	2	...	...
Muralgarra ...	43	2	104	7
Wydgee	45	3	...	...
Gullewa House ...	47	3	233	9
SOUTH-WEST DIVISION (NORTHERN PART):				
Murchison House	160	6	...	...
Mt. View ...	48	4	...	...

RAINFALL—*continued.*

Stations.	June. No. of points. 100 = 1in.	June. No. of wet days.	July. No. of points. 100 = 1in.	July. No. of wet days.
South-West (Northern)—*contd.*				
Mumby	211	9	356	2
Yuin	24	2	113	5
Northampton ...	311	8	564	10
Oakabella ...	...	...	...	...
Narra Tarra ...	...	...	...	...
Tibradden ...	229	9	399	13
Myaree	206	9	430	12
Sand Springs ...	251	7	373	7
Mullewa... ...	80	6	206	11
Kockatea ...	113	5	220	7
Bootenal ...	...	...	...	...
Geraldton ...	238	9	447	12
White Peak ...	228	5	...	...
Greenough ...	229	9	453	9
Bokara	379	11	383	16
Dongara ...	434	9	294	10
Brookman's Hills	171	8	272	7
Strawberry ...	...	...	467	13
Nangetty ...	144	6	276	11
Mingenew ...	231	11	363	13
Urella	199	7	350	8
Yandenooka ...	237	10	502	13
Rothesay ...	...	...	...	...
Ninghan	26	4	...	...
Field's Find ...	13	2	81	7
Carnamah ...	135	8	350	10
Watheroo ...	220	10	377	12
Dandaragan ...	328	13	634	13
Moora	250	11	444	13
Yatheroo ...	295	8	...	...
Walebing ...	223	12	455	17
Round Hill ...	182	12	347	14
New Norcia ...	187	9	...	...
Wannamel ...	360	10	593	14
South-Western Division, Central (Coastal):				
Gingin	358	10	1068	14
Belvoir	385	10	876	15
Mundaring ...	542	9	936	14
Wandu	436	14	776	20
Guildford ...	395	12	777	17
Kalbyamba ...	439	9	558	17
Canning W't'r'w'ks	496	9	554	12

Stations.	June. No. of points. 100 = 1in.	June. No. of wet days.	July. No. of points. 100 = 1in.	July. No. of wet days.
South-West (Coastal)—*contd.*				
Perth Gardens ...	542	10	681	16
Perth Observatory	467	12	683	19
Subiaco	414	12	657	18
Claremont ...	319	6	...	...
Wanneroo ...	408	10	972	17
Jandakot ...	655	8	539	13
Fremantle ...	283	11	474	17
Rottnest	293	13	504	16
Armadale ...	594	13	757	17
Rockingham ...	339	11	469	13
Jarrahdale (Norie)	582	14	...	...
Jarrahdale ...	682	14	943	17
Serpentine ...	493	14	679	17
Mandurah ...	538	12	886	16
Pinjarra (Blythewood)	451	15	708	19
Pinjarra	522	13	822	18
Yarloop	549	14	622	18
Harvey	604	16	692	15
Upper Murray ...	619	14	821	18
South-West, Central Part (Inland):				
Hatherley ...	153	6	294	8
Dowerin ...	148	8	299	10
Momberkine ...	213	8	415	9
Warramuggin ...	161	1	...	...
Newcastle ...	272	9	656	14
Emungin ...	142	9	299	12
Eumalga ...	267	11	687	14
Eadine	235	48	562	16
Northam ...	197	9	452	16
Grass Valley ...	146	8	453	11
Meckering ...	128	8	344	8
Cunderdin ...	145	8	329	9
Codg-Codgin ...	...	...	205	9
Doongin	88	5	209	8
Cutenning ...	102	8	156	9
Whitehaven ...	183	6	...	...
Cardonia ...	...	...	184	6
Sunset Hills ...	195	8	388	12
Jetcobine ...	...	...	481	13
Cobham	210	13	541	13
Yenelin	172	10	...	...
Mt. Caroline ...	140	6	224	9

RAINFALL—*continued.*

Stations.	June. No. of points. 100 = 1in.	June. No. of wet days.	July. No. of points. 100 = 1in.	July. No. of wet days.
South-West (Central)—*contd.*				
York	191	12	500	14
Dalebridge ...	188	9	456	11
Beverley ...	206	8	581	11
Bally Bally ...	223	10	387	13
Oakdale	221	12	415	14
Barrington ...	193	10	417	13
Qualin	202	7	266	6
Stock Hill ...	247	7	354	8
Sunning Hill ...	254	12	367	14
Brookton ...	227	8	339	9
Wandering ...	341	8	620	15
Glen Ern ...	272	11	436	17
Pingelly ...	231	8	375	11
Yornan	220	11	352	15
Marradong ...	377	9	631	15
Wardering ...	220	7	252	10
Bannister ...	363	11	...	...
Wounaminta ...	251	3	...	...
Narrogin ...	247	10	334	13
Narrogin State Farm	268	10	411	14
Wickepin ...	256	11	326	13
Gillimaning ...	260	9	271	13
Bunking ...	252	6	...	...
Bullock Hills ...	182	10	232	8
Bullingarra ...	...	...	...	...
South-West Division (Southern Part):				
Bunbury ...	521	15	754	20
Brunswick ...	554	11	702	14
Collie	531	15	732	19
Glen Mervyn ...	567	12	743	13
Donnybrook ...	658	13	677	20
Boyanup ...	641	11	671	14
Ferndale ...	602	13	514	14
Busselton ...	468	15	559	22
Quindalup ...	560	16	691	21
Cape Naturaliste	409	14	641	23
Glen Lossie ...	619	17	649	22
Lower Blackwood	696	11	522	14
Karridale ...	684	20	694	26
Cape Leeuwin ...	659	22	662	25
Biddellia ...	798	18	709	14

Stations.	June. No. of points. 100 = 1in.	June. No. of wet days.	July. No. of points. 100 = 1in.	July. No. of wet days.
South-West—(Southern)—*cont.*				
The Warren ...	624	15	527	23
Lake Muir ...	432	13	415	18
The Peninsula ...	535	20	490	27
Mordalup ...	343	12	288	17
Deeside	441	14	461	21
Riverside ...	497	12	474	18
Balbarup ...	488	12	632	13
Wilgarup ...	574	15	558	22
Cundinup ...	342	13	...	...
Bridgetown ...	444	15	465	20
Westbourne ...	356	16	392	15
Hilton	402	...	426	10
Greenbushes ...	516	8	...	...
Greenfields ...	461	14	498	13
Glenorchy ...	415	12	370	9
Williams ...	208	10	324	10
Arthur	226	7	354	...
Rifle Downs ...	377	7	...	...
Darkan	315	9	...	...
Wagin	242	11	223	15
Glencove ...	239	15	288	11
Dyliabing ...	192	12	208	10
Katanning ...	375	17	311	10
Kojonup ...	398	16	435	15
Broomehill ...	304	16	266	8
Woolaganup ...	96	12	138	11
Sunnyside ...	359	17	303	12
Talbot House ...	185	9	504	14
Woodyarrup ...	278	14	337	16
Mianelup ...	186	11	167	12
Cranbrook ...	255	11	217	15
Toolbrunup ...	201	11	200	9
Tambellup ...	239	16	254	13
Blackwattle ...	341	10	222	11
Woogenellup ...	244	13	270	11
Mt. Barker ...	253	19	180	16
Kendenup ...	269	12	185	14
St. Werburgh's...	317	15	...	...
Forest Hill ...	301	19	...	...
Wilson's Inlet ...	450	20	371	19
Denmark ...	...	...	...	...
Grasmere ...	456	16	299	19
Albany	427	20	306	21
King River ...	270	10	193	11
Point King ...	499	18	314	14
Breaksea ...	487	13	292	24
Cape Riche ...	227	9	...	...
Cherilalup ...	...	...	...	...
Pallinup... ...	258	14	243	9

RAINFALL—*continued.*

Stations.	June. No. of points. 100 = 1in.	June. No. of wet days.	July. No. of points. 100 = 1in.	July. No. of wet days.
South-West—(Southern)—*cont.*				
Bremer Bay ...	186	14	...	...
Peppermint Grove	237	13	...	...
Jarramongup ...	158	8	...	...
Chillinup ...	...	...	...	...
Eastern Division:				
Dural	7	1	...	...
Wiluna	18	2	32	3
Gum Creek ...	23	2	Nil	...
Mt. Sir Samuel ...	18	2	31	2
Lawlers	1	1	74	6
Leinster G.M. ...	Nil	...	...	...
Darda	91	3	...	...
Lake Darlôt ...	...	...	...	...
Duketon ...	49	3	...	...
Salt Soak ...	70	4	...	...
Mt. Leonora ...	12	1	72	4
Mt. Malcolm ...	Nil	...	46	2
Mt. Morgans ...	Nil	...	35	2
Burtville ...	...	...	...	...
Laverton ...	15	1	37	3
Murrin Murrin...	Nil	...	37	2
Yundamindera ...	9	1	93	3
Tampa	10	1	61	2
Kookynie ...	26	1	97	3
Niagara	60	1	90	2
Yerilla	10	1	95	3
Quandinnie ...	42	3	...	...
Edjudina ...	32	2	106	3
Menzies	30	2	128	4
Mulline	41	3	74	6
Waverley ...	31	2	...	...
Goongarrie ...	54	4	67	5
Mulwarrie ...	45	...	63	...
Bardoc	42	3	56	3
Broad Arrow ...	35	2	33	3
Kurnalpi ...	40	2	57	2
Bulong	25	2	37	4
Kanowna ...	28	4	48	4
Kalgoorlie ...	30	3	36	6
Coolgardie ...	50	4	29	5
Burbanks ...	53	2	53	2
Woolubar ...	34	3	15	2
Widgiemooltha...	24	3	33	4
50-Mile Tank ...	33	5	29	4

Stations.	June. No. of points. 100 = 1in.	June. No. of wet days.	July. No. of points. 100 = 1in.	July. No. of wet days.
Eastern—*contd.*				
Waterdale ...	32	4	54	4
Norseman ...	21	4	10	2
Lake View ...	47	5	28	3
Bulla Bulling ...	60	3	47	3
Boondi	23	1	67	6
Boorabbin ...	21	3	84	5
Koorarawalyee ..	60	5	77	10
Karalee	45	2	88	3
Yellowdine ...	10	1	80	3
Southern Cross...	30	2	97	3
Parker's Range...	43	6	104	10
Parker's Road ...	44	3	110	3
Mt. Jackson ...	27	4	59	5
Bodallin ...	22	3	113	6
Burracoppin ...	...	...	...	...
Boandee ...	...	...	111	5
Kellerberrin ...	137	7	201	10
Merredin ...	97	4	167	7
Nangeenan ...	76	5	157	6
Mangowine ...	61	5	183	8
Wattoning ...	...	...	...	...
Noongarin ...	61	2	...	...
Eucla Division:				
Ravensthorpe ...	136	12	77	9
Coconarup ...	126	13	80	5
Hopetoun ...	155	9	106	4
Fanny's Cove ...	127	8	...	...
Park Farm ...	153	12	192	10
Esperance ...	203	13	122	10
Gibson's Soak ...	219	11	147	9
30-Mile Condenser	167	8	100	7
Swan Lagoon ...	116	6	70	5
Grass Patch ...	...	...	...	...
Myrup	200	13	...	...
Lynburn ...	163	11	...	...
Boyatup	224	13	...	...
Middle Island ...	...	...	...	...
Point Malcolm ...	187	16	...	...
Israelite Bay ...	116	13	23	4
Balbinia	...	...	...	...
Frazer Range ...	38	1	...	...
Balladonia ...	32	2	9	3
Southern Hills ...	18	2	...	...
Eyre	68	10	35	5
Mundrabillia ...	...	...	...	...
Eucla	54	8	23	5

The Observatory, Perth,
9th August, 1905.

W. E. COOKE,
Government Astronomer.

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EDITOR'S NOTES.

WIRELESS TELEGRAPHY.—A Bill has been introduced into the Senate by the Postmaster General which, if passed, will prevent station-holders from erecting wireless telegraphy on their property.

RABBIT DISEASE.—The New South Wales Government having been disappointed with the failure of Dr. Danysz, of the Pasteur Institute, in trying to introduce a disease amongst the rabbits in that State, has decided to place the matter in the hands of local men of science. It is to be hoped that some good will result from this step.

SWEET POTATOES.—As this is the time for preparing ground for the planting out of the vine slips of sweet potatoes, those farmers who have not already tried a crop of this should certainly do so as they rank as one of the very best of foods for pigs, cattle, and private use. They are very prolific, easily grown, and require very little attention.

SHEEP RETURNS.—From our exchanges we note that New Zealand has increased her flocks during the past year by nearly a million head (907,000), bringing the number up to 19,121,000. This number is a little over a million less than it was in 1902. The actual figures are:—(1902), 20,342,000; (1903), 18,954,000; (1904), 18,280,000; (1905), 19,121,000.

AGRICULTURAL LECTURES.—Our readers' attention is drawn to a notice appearing on page LXI. of the present issue, announcing a course of lectures to be given on agriculture and kindred industries. As each lecture will be given by an expert, those attending can be assured of gaining some very valuable information. The lectures are free, and open to the general public.

Lead Poisoning of Cattle.—Numerous fatalities have occurred among cattle after drinking water from the tailings of a quartz-stamp mill. An analysis of this water showed traces of arsenic, somewhat more copper, and 2·64 to 3·21 per cent. of lead in the form of white carbonates. The symptoms observed in the poisoned animals were those which are produced by lead, and it is believed that the carbonate of lead was the cause of death.

Substitute for Bordeaux Mixture.—Elsewhere in this issue appears a paper by Mr. Despeissis, the Horticultural and Viticultural Expert of the Department of Agriculture, giving the formula of a mixture called "Burgundy Mixture," a substitute for "Bordeaux Mixture." The difference being that in the former ordinary washing soda is used in place of lime. The article also contains instructions for the testing of the mixture, which is so simple in itself that we ought never to hear of trees being burnt through the use of either mixture again.

A Check to Red Scale.—A letter has been received by the Agricultural Department from Mr. A. C. R. Loaring, of Heidelberg, beyond Kalamunda, setting forth in glowing terms the efficacy of the ladybird as a means of dealing with red scale. Mr. Loaring had already tried various specifics in spraying and fumigating, when, in answer to an application, he received a colony of 30 ladybirds from the Entomologist's Department. From that day forward Mr. Loaring paid all attention to the parasitic cure, with the result, he declares, that his orchard is in a much more satisfactory condition with respect to red scale than are those of his neighbours, who are still clinging to the older methods of spraying and fumigating.

Potato Scab.—A correspondent writes stating that he has a crop of potatoes, 50 per cent. of which are attacked with scab, and asks what is the best thing to do for them. The matter being referred to the Horticultural and Viticultural expert, Mr. Despeissis replies as follows:—No treatment will now stay the spread of scab producing fungus on the potatoes. The best treatment for that disease is the preventive one, and consists in treating the tubers before planting. The seed should be dipped in a solution of corrosive sublimate, 2oz. in 20 gallons of water, for two hours. This solution is very poisonous and care should be taken that no stock can get near the tubs containing it. A safer dip is that composed of formalin, 1lb. in 10 gallons of water. Beetroots are also attacked with the same disease, and as the fungus remains in the ground for several years without losing its vitality, potatoes and beetroots should not, therefore, follow one another in the same ground.

Clearing Bracken Land.—Many enquiries have been recently made as to the best way of clearing land of bracken fern. To those who have land of this kind lying idle, and desirous of cultivating it, we would recommend them to go in for a system of continual cultivation during the summer months, which will work out all the bracken by root exhaustion, and will in addition greatly improve the land by sweetening it. By keeping the plant cut above ground the vitality of the roots is impaired; then, adding a heavy dressing of lime (about half a ton to the acre) would materially assist in decomposing the root system of the ferns, and thus bring about their

permanent extinction. This method is preferable to the use of scrub exterminators or other chemicals injurious to vegetation, as there is always a fear of sterilising the ground so treated, and so making it unfit for anything that may be afterwards planted. It should be possible to get the land free enough in six or nine months to permit of fruit trees being planted during the following winter. Should an isolated fern still persist in growing it could easily be removed by the hoe.

Dr. N. A. Cobb.—One of the first appointments made under the Department of Agriculture of New South Wales when it was created, 15 years ago, was that of Dr. N. A. Cobb. During that time, when he occupied the position of Government Vegetable Pathologist, the investigation of many problems affecting those diseases of plants and of farm stock of parasitic nature were taken in hand by Dr. Cobb with results, when calculated in money value, must be considerable. The news of Dr. Cobb's appointment to the position of Director of the Division of Pathology and Physiology in connection with the Experiment Station of the Hawaiian Sugar Planters' Association, Honolulu, while reflecting great credit on Dr. Cobb himself, will prove a loss both to Australia as a whole and the individual settler in particular. On all occasions when advice was sought on questions of plant diseases, our own Department has also found Dr. Cobb ready to assist, and his severance with the sister Department of Agriculture in Sydney will prove a loss to Western Australia alike. In the next issue a review of Dr. Cobb's recently published "Letters on Diseases of Plants," issued by the Department of Agriculture in Sydney, will appear in the pages of this *Journal.*

Nitrogen Inoculation.—The only direction in which soil inoculation has been rendered more or less practicable, according to Professors Voorhees and Lipman, is the inoculation with culture of various tubercle bacteria. Such inoculation can therefore be applied to legumes, and legumes only. By so doing, we may make possible the formation of tubercles, and therefore the fixation of nitrogen by leguminous crops in such soils where the proper bacteria are naturally absent. But it should also be remembered that in most soils, the failure of leguminous crops to grow satisfactorily is due, not to the absence of the proper soil bacteria, but to the general unfavourable soil conditions, to absence of a sufficient amount of lime, of a sufficient amount of humus, or of sufficient æration. The inoculation of such soils without previous improvement would be a waste of effort and money. There is ample justification, therefore, to utter here a warning against misconception and unjustifiable expectation. Ignorance in this direction will be exploited, as ignorance in other directions has been exploited, by attempts to sell to farmers improperly informed cultures of soil bacteria, advertised as the panacea for all soil ills. Let the man who wishes to inoculate his soil remember that it is not yet practicable to inoculate it for wheat or potatoes or melons, and while it is practicable to inoculate it for lucerne or soy beans or other legumes, he should inform himself as to the real facts before proceeding with his inoculation.

Dehorning Calves.—It is surprising the number of calves one sees, in going about the South-Western districts, that have been allowed to let their horns grow. To say the least of it, it is a mistake. In yarding, horned

cattle take up a great deal more room, and are liable to cause injury to others, whilst a very little trouble at the proper time will prevent it. A writer in *Hoard's Dairyman*, replying to a question as to the best time to operate on calves so that the horns will not grow, states:—"This reminds me of the necessity of telling all that raise cattle that the best way to dehorn is the day the calf is dropped. Let the calf suck its dam all it wants, and then the calf will lie down and sleep soundly and you can go to it and hunt for the little button on its head where the horn will start. There you can find a little spot that has no hair, and you just rub a little caustic potash on that spot and the calf will not wake up from the operation. The horn will not start to grow and the calf will never know what happened, and will have as smooth a head as a muley. Get one shilling's worth of caustic potash and put in a bottle with just enough water to dissolve it, and put in a glass stopper, and when you want to use some, take a pine wood stick like a lead pencil and stick it into the fluid and rub on the little button, and the next day if there is a little dent there the horn is dead; if not put on a little more, but not too much so the fluid runs down. It will take the hair off where it goes. The common box lye will do the work, but don't put on so much that it runs down the head. By all means keep the horns off. The cow has no more need to carry horns nowadays than a man has need of carrying a revolver in company or society."

Horse Breeding.—The time is at hand when the question of improving our conditions for horse-breeding (especially army remounts) should receive careful attention from all who understand the importance of this national industry. Twenty years ago, Australian-bred horses were considered second to none in the world, and in the opinion of army authorities, our "walers" were superior to all army remounts; yet we know that our horses shipped to South Africa were a sorry lot as a whole, and the deterioration surprised officers who knew the Australian army remount a few years previously in India. The cause of this decline in quality is unfortunately only too apparent. Horse-breeders have received little or no encouragement. By a short-sighted policy the general breeder considered that a high-priced stallion of first quality did not pay, and the inferior animals were mated, with the result that nature's law "like begets like," was fulfilled, and the fine broad limestone pastures of many of our horse-breeding districts became the home of what was considered "average quality." For years past various suggestions have been made for the purpose of retrieving what we have lost in this direction, and the general opinion is that stallions should be heavily taxed. In 1901 the Remount Commission, in its report to the Indian Government, made the following recommendations:—"We think it would be beneficial to the industry if you were to advise the Australian Governments to put a heavy tax on stallions and limit the exportation of mares suitable for breeding, also that the Government should supply a number of stallions for the use of breeders at a nominal fee for service." The question is of national importance, and we think that if the Government of our own State, already showing progressive work in opening the available land for settlement, and assisting other branches of rural pursuits, were to appoint a commission, collect evidence, and act upon the opinion of such a commission, the other Australian States would follow the example and horse-breeding throughout Australia would again become one of our most important industries.—*Farmer and Grazier*.

Wheat-growing Experiments.—Some interesting experiments in wheat-growing have been undertaken by the Lawes Agricultural Trust, Rothamstead, England, the results of which have recently been published. The experiments cover a period of 55 years, commencing in 1851 and ending in 1905, and embrace the cultivation of wheat, alternating with fallow without manure and wheat grown continuously without manure. During the first five years the yield per acre averaged 19·2 bushels after fallow, and 14·7 bushels when wheat followed continuously, showing a difference in favour of the fallow of 4·5. When averaged over a period of 40 years—1856 to 1895—the returns were: wheat after fallow, 17·4 bushels, and wheat following wheat year after year, 12·8 bushels per acre, showing an average increase in yield after fallow of 4·6 bushels. Experiments with wheat following leguminous crops give an evidence of the value of the rotation of crops. Wheat was planted after lucerne, peas or beans, Bokhara clover, sainfoin, white clover, red clover, and vetches; the yield being, from the year 1899 to 1903 inclusive, on an average, as follows:—After lucerne, 27 bushels; peas or beans, 20 bushels; Bokhara clover, 22 bushels; sainfoin, 23 bushels; white clover, nearly 24 bushels; red clover, 23½ bushels; vetches, 20 bushels. From the result of these experiments it would appear that greater returns were obtained from the wheat crop following lucerne; but it would have to be borne in mind that the cultivation after lucerne would have to be thorough, and the soil would need to be treated for any acidity that may be left after the root system which the lucerne had developed in the ground during a number of years. The clovers show that they come next to lucerne as nitrogenous fertilisers; while peas, beans, and vetches show equal power, but are lower in the scale, according to these experiments, in respect to fertilising properties.

Cats as Rabbit Destroyers.—A correspondent to the *Australasian*, in commenting on the presence of cats in the burrows of a rabbit-infested district, drew the inference that as the cats lived in apparent amity with the rabbits, they could not prey upon them. The tame cats that have taken to a wild life grow to a great size, and we are told they pay the trappers as well as, if not better, than the rabbits. About the same time the following news item was wired from Brisbane:—"In a report to the Gregory North Rabbit Board, the superintendent of works, Mr. F. C. Trotman, stated, in reference to an inspection of portion of the fence, that he was much gratified to find so few traces of rabbits. This he attributed to the myriads of wild cats (domesticated breed) which abound all along the line. These were the greatest enemies the rabbits had. It was astonishing where the cats came from. He believed they were very numerous on the southern boundary fence, and if so, he hoped they would almost rid the district of rabbits in those localities." I can bear witness to the excellent work done by cats in clearing the rabbits off a property. Some years ago I was invited by Mr. F. Armytage to visit his estate of Wooloomanata, near Geelong, to see the result of an experiment in turning out a number of cats on the place, which before they came, was fairly swarming with rabbits. We went over the property with guns and ferrets, and where, before the cats were established, Mr. Armytage had shot 50 couple in a day, we found very few indeed, and not a single young one. On the common a short distance away, where everyone was allowed to shoot and trap, we got any number of rabbits out of the burrows. The cats begin by living on the young rabbits, and as the

supply becomes scanty they then fall back on the grown ones. If my memory serves me rightly, we did not see a dozen rabbits while on Mr. Armytage's property, and to my intense astonishment, I shot nine rabbits running on the common. What became of the cats eventually I never heard; probably they would dispose of each other, after the fashion of the famed Kilkenny cats. Since writing the above, I have learned from Mr. Armytage that while the cats lived the rabbits were completely kept under. Unfortunately, the trappers found that cat skins were more valuable than rabbit skins, and this proved fatal to the cats.—*Australasian.*

Fat in Milk.—There is probably no other dairy question that has received any more discussion and so unsatisfactorily answered as the one: To what extent is the composition of milk, especially its fat content, influenced by feed? A bulletin issued by the Cornell Experimental Station on this subject states:—"For a long time the opinion has been very strong in the minds of dairymen that the percentage of fat in milk is directly and largely influenced by the food of the cow. If ninety-nine out of a hundred dairymen are asked whether they can make their cows give richer milk by changing food, they will answer at once in the affirmative, and many will go so far as to say that they have done it time and again. Still this is one of the results that careful investigators have been trying to secure for the last 20 years, and so far they have met with little or no success." In summing up all the work done there is nothing to indicate that, on general terms, it is possible to materially and permanently increase or diminish the percentage of fat in the milk. It has been suspected that the results were not conclusive; for the experiments were always made with cows that had been well fed and well cared for. In view of these facts a herd of 21 cows, kept in rather poor condition, was selected to determine what effect liberal feeding would have upon the per cent. of fat in the milk. The herd was tested during one lactation period on the farm, and then 10 of the cows were removed to the station, where they were fed and cared for scientifically. The bulletin is summarised as follows:—"In a herd of poorly fed cows an abundant ration, easily digestible and rather nitrogenous in character, and continued through two years, resulted in an average increase of one-fourth of one per cent. of fat in the milk, or a percentage increase of about 6 per cent. This was accompanied by an increase of about 50 per cent. in total milk and butter fat produced. The increased production was secured economically so far as the food cost of fat and milk is concerned." Nothwithstanding the fact the cows were kept under adverse conditions upon the farm, the test was increased only one-fourth of one per cent. when fed liberally and receiving the best of care. With all the other data that has been accumulated upon this subject of feeding fat into milk, we feel quite certain that when cows are kept in normal condition there is no feed or combination of feeds that will materially alter the per cent. of fat in the milk. In other words, fat is bred into milk and not fed into milk. But we should not fail to note the wonderful increase of total milk and fat produced when the 10 cows were fed and cared for by the University. The increase amounted to about 50 per cent. This indicates that it is not always the cows that are responsible for the low average yields, but that the man behind the cow is of equal importance.

Condiments.—For many years various condimental feeds and condition powders have been offered to the public as a panacea to all ills that stock and poultry are subjected to. Very many of these foods are made up of

some bulky matter, and, in case of poultry condiments, shell and grit are both added to make weight. The average poultry food or tonic is a compound chiefly of wheat, with a small percentage of some drug, not enough in itself to do any good, even if suitable, the main object being to raise the cost of wheat from about 4s. per bushel to £3. The following analyses are taken from one of the experimental stations of the United States bulletins:—"One of the poultry tonics is shown to consist very largely of wheat feed, to which has been added salt, oyster shells, saltpetre, Glauber's salt, iron oxid, and probably asafœtida. The protein content of this product, 9·69 per cent., would seem to indicate that about two-thirds of the mixture consisted of the wheaten material. The addition of thirty-three pounds of drugs to sixty-seven pounds of wheat feed, however, has caused the mixture to sell at the rate of £4 per hundred, while the best wheat feed can be purchased in our markets at the present time at 5s. per hundred retail; in other words, the thirty-three pounds of drugs added have cost the consumer £3 17s. 6d. per hundred. Another condition powder consists chiefly of wheat feed, with oats, sulphur, saltpetre and Epsom salts added. It contains 14·9 per cent. protein and but 9·1 per cent. ash, showing that a very small amount of mineral drugs had been added—probably less than five per cent. This small quantity of drugs, however, has been sufficient to raise the price of the wheat feed from 5s. to £7 15s. per hundred, a charge of £7 10s. per. hundred being made for the drugs. Another sample, a stock food, consists of wheat feed and corn meal, to which have been added salt, linseed meal, Glauber's salt, carbonate of lime, saltpetre, charcoal, sulphur, resin and a little iron. The amount of ash, 20·5 per cent., shows that the added drugs make up about one-sixth of the mixture. The price of the wheat and corn in this sample has been raised from 5s. to £3 17s. 6d. per hundred, a charge of £3 12s. 6d. per hundred being made for the drugs. Still another sample consists of an inferior wheat product, and salt, carbonate of lime, Epsom salts, carbonate of soda, fenugreek and resin. The feed portion of this mixture is largely make-weight, as the sample contains but 5·6 per cent. protein and is practically worthless. It contains 52·4 per cent. ash, over 37 per cent. being common salt. Thus we have a sample: one-half of matter of low feeding value, one-third common salt, and the remainder drugs of more or less value; its cost is £2 10s. per hundred. The purchaser of this material practically bought common salt, adulterated with a wheat product and common drugs, and instead of paying the market price of 2s. per hundred for salt, paid £2 8s. per hundred additional for what was in reality an adulterated article. These illustrations, chosen at random, are typical of nearly all the materials under consideration, and show most clearly that purchasers of them pay a very excessive price for the supposed skill used in compounding them. The Station does not in any way detract from the usefulness and value of many of the constituent remedies used by the compounders of condimental feeds, but it cannot state too emphatically its belief that when an animal is in need of treatment, medicines should be used under the competent and wise direction of a skilled veterinarian, or according to methods which the feeder's experience has shown to be efficacious. Good and satisfactory results cannot hope to be secured when a hit-or-miss policy is adopted, or when the good, common sense of the feeder is temporarily supplanted by the specious claims of these patent medicines. Even granting that the efficiency of these mixtures was beyond all question of doubt, the feeder who wishes to maintain his business on strict economic principles cannot afford to experiment with condimental feeds."

TO MAKE ENSILAGE CHEAPLY.

By the EDITOR.

From long experience the leading authorities in the United States now contend that the best milk produced at the greatest net profit is through ensilage. The cows producing this milk are of course not fed exclusively on ensilage, but it is because of the cheapness and intrinsic value of ensilage as a feed that such milk can be produced so cheaply. There is no country which more requires some such method of conserving fodder for dairy cattle than Western Australia; and for this reason we would urge those farmers who desire to lay by a store of good succulent fodder for their stock during the dry period of the year to seriously consider the value of ensilage. The interest in silage is growing rapidly among farmers in the principal progressive countries of the world. They appreciate the necessity of a cheaper ration as well as the importance of a succulent feed. In fact silage is now regarded as an indispensable adjunct to successful farming.

To make ensilage on proper lines it is of course necessary to have a silo substantially built in conformity with the plan experience has proven to be the best; but ensilage can be made successfully in the stack, and the cost of a silo thus saved to the farmer with limited means just starting on his land. There will be some loss however round the edges of the stack owing to the air getting into the silo for a distance of perhaps one foot; and in this regard it is debatable whether a properly constructed silo would not pay better in the end, especially when the material used for the silage has to be grown under ordinary cultivation. As a means of directing the attention of farmers to the expediency of conserving fodder by means of ensilage, and thus save the surplus growth of herbage, grass, and other fodder which stock will eat, for a time when green feed has gone from the farm, some advice is here given regarding the making of stack-ensilage, because it is the simplest and least expensive method.

ADVANTAGES OF THE STACK SYSTEM.

Some of the advantages of the stack system of making ensilage are explained by Mr. A. Conlon, the Government Dairy Instructor in Tasmania; and the experiences of Mr. Conlon are worth recording. He refers to the fact that "an ensilage stack can be put up anywhere in the field and a great saving in cartage thus effected. It is also easier," he contends, "to make sweet ensilage in the stack form than by the use of rigid silos; and a stack has unlimited capacity—that is, it can be made of any size suitable to the quantity of fodder grown. There is also less waste in the larger stacks, owing to the fact that the larger the stack the less the exposed surface in proportion to the mass."

There are two kinds of silage—sweet and sour. It is with the former that we are concerned in the present instance, as being the most suitable to make under the stack system. It is in controlling the result, or, in other

words, in the production of sweet or sour at will, that the whole art of ensilage exists.

If, after carting the green material, heavy pressure is at once applied the air is excluded, and the temperature of the mass is consequently kept at a low level. When by this means the temperature is prevented from rising above 120deg. F. to 150deg. F. sour ensilage results. For the production of sweet ensilage the mass must not be weighted to any great extent before the temperature has reached from 130deg. F. to 150deg. F. Care must be taken not to allow the temperature to rise above 160deg. F., or the stack will become overheated and burnt. The intelligent use of the thermometer is the chief factor in successful ensilage making; and to neglect this and the few simple details referred to, failure in the quality of the ensliage would result. An ordinary floating dairy thermometer is the most convenient type to use, an iron pipe of slightly larger diameter being built into the middle of the stack in a vertical position. The thermometer may then at any time be lowered by a string, and the temperature taken at any required depth.

How to Build the Stack.

The site for the stack should be level, and a thick layer of straw should be laid down as a foundation. The size and shape of the stack is governed by estimating that for every three tons of hay the crop would have produced, about ten tons of silage may be reckoned on. Having arrived at an approximate estimate of the weight, the base measurements should be somewhat as follow :—For 15 tons, 9ft. by 9ft. ; 20 tons, 10ft. by 10ft.; 50 tons, tons, 13ft. by 13ft.; 100 tons, 16ft. by 16ft.

Only as much of the crop as can be carted and stacked in one day should be cut; a day or two should elapse before adding more material. This allows the temperature to rise, and also the mass to subside, which facilitates the work of stacking. In the ordinary haystack the sides are built projecting outwards—this must be carefully avoided in building silage stacks. It is far better to have the sides and ends inclining inwards, for there is then less tendency for the stack to lean over, which frequently happens owing to the fermentations causing unequal settling of the mass. Should this occur, props must be set—at a wide angle—to the leaning side, when, on further subsidence taking place, the pressure brought to bear will bring the stack back to the perpendicular.

From the first load to the completion of the stack the greatest attention should be paid to the outside edges. This is a very important point. The outsides should always be kept higher than the centre when stacking, and should be made much more compact by being well trodden down, the centre being left comparatively loose. When finished the top should be levelled, and covered with a layer of straw, pressure being then applied by piling the handiest material procurable on the top, so that a dead weight of about 1cwt. per square foot is secured. Stack ensilage has been successfully made without any pressure other than the weight of the material being used for ensilage, but when no pressure is applied more loss occurs round the edges of the stack.

Any succulent growth, so long as it contains nothing deleterious to stock, may be made into ensilage in this manner, or special crops may be grown for the purpose. Surplus growth of grasses which frequently abound

in the fields during the spring time could be cut and stacked as ensilage, thus providing excellent fodder for the dairy cattle when the dry period of the year comes round. It is necessary to fence the silage stack securely to keep away the stock, for once they get a taste of ensilage it is difficult to keep them from rushing it—no matter how good the surrounding feed.

INTERSTATE CONFERENCE OF FRUIT GROWERS.

The conference of interstate fruit growers was held at Melbourne on 6th September, with Mr. W. T. Campbell (Director of Agriculture, N.S.W.), in the chair. The visitors included Mr. Swinburne (Minister for Agriculture, Victoria), who, in an opening speech, said that with the aid of the Federal Government there was a possibility of obtaining a reduction of freight on fruit exported.

The conference discussed the matter of a uniform fruit-case, and the use of the following was agreed upon:—For apples only, 20in. x 10in. x 15in. (external measurement); and for soft fruits, a case of an Imperial bushel capacity, without regard to shape.

On the question of fruit pests, Mr. Shoobridge (Tasmania) moved that the Minister for Agriculture in each State be asked to appoint four delegates—a Government officer, a fruit-grower, a nurseryman, and a shipper—to meet and frame regulations regarding the interstate trade in trees and fruits.

This was agreed to.

Other resolutions agreed to were:—(1) That shipping companies be asked to give attention to the more careful handling of fruit; (2) that the conference protest against the South African prohibition of clean fruit-trees and plants; (3) that a protest be made regarding the regulations against the admission of fruit to Western Australia; (4) that the Federal Parliament's attention be called to the duty of 2s. per case on fruit imported into Germany.

It was decided to hold the conference annually, and that the next conference be held in Sydney.

A proposal for a rebate of the sugar duties was brought forward. Mr. Wettenhall (Victoria) moved that the Prime Minister be asked to consider a request for the rebate of the full amount of duty on sugar used in manufactures having fruit for their bases, whether for export or for home consumption.

Mr. H. Jones (Tasmania) said that for an acre of plums the grower received £10, but in turning the plums into jam, £30 duty was paid on the sugar.

Mr. Glynn, M.H.R., said it would be better to ask for a reduced import duty and the continuance of the excise duty.

After a good deal of discussion, the motion was agreed to.

THE CULTIVATION OF FLAX.

Flax, or linseed *(Linum usitatissimum)* is valuable for stock feeding, and is grown both for its fibre and its seed. Flax is also cut just after blossoming and before seed development and used for hay; it makes an excellent fodder, being rich in protein and containing about the same amount of fibre as Timothy hay. The product of the flax as linseed meal contains 35·9 of protein, 36·8 of nitrogen, free extract, and 3·0 of fat. There are several varieties of flax. White Blossom, Dutch Riga, and Belgium are among the best.

A moist, deep, strong loam, well underdrained, is considered the best soil for both fibre and seed production. Recent experiments have shown that flax, contrary to the usual belief, is not so exhausting to the soil as either corn or oats. It is a dainty feeder, however, and absorbs most of the mineral fertilisers needed in its development during the first 45 or 50 days of its growth. For these reasons, soil for flax must be especially well prepared by deep ploughing and working into a fine mellow seed-bed, in order that the food that the plant requires is in the best and most readily available form. Nitrogen is the element most needed by the flax crop, and this can be best supplied by ploughing in some nitrogenous plants such as clover, or peas and beans. Flax seed can be sown in the spring, as soon as the ground begins to warm up. When grown for seed 2 to 3 pecks are sown per acre; this gives room for the flax stalks to branch and produce many flowers and an abundance of seed. When the fibre is required from 1½ to 2 bushels of seed are sown; with this thicker seeding the plants grow closer together, and, instead of branching stalks, but one straight stem is produced, from which a fibre of better quality is obtained. A crop is seldom grown for seed and fibre at the same time, though this method is common in the best flax districts of foreign countries, the flax being pulled before the straw is too ripe and hard. Flax seed is usually sown broadcast by hand, or with a broadcaster, and seldom drilled in unless grown for seed. When sown broadcast the seed should be lightly harrowed in, followed on the lighter soils by the roller. Only seed of the best quality should be sown.

Where the ground is clean the crop will not require any attention, but if weeds are abundant in flax grown for fibre they should be pulled out. Flax grown for seed should be harvested when the seeds are full and plump and of a good colour. The best method of harvesting is with a binder. After the bundles are well cured out, they may be put in small stacks or stored in the barn until threshing time. The flax is threshed with a common grain threshing machine.

Heretofore it has been impossible to grow flax on the same land year after year without the soil becoming "flax sick." The reasons for this have remained unknown until recently discovered by Prof. Bolley; and which is referred to in the *Farmers' Cyclopedia of Agriculture.* It is due to a fungus disease. It attacks plants at all stages of growth, and they die early or late, according to the time and intensity of the attack. If the soil is much infected the plants are killed before they reach the surface of the ground. When plants two to five inches high are attacked they wilt suddenly, dry up,

and soon decay, if the weather is moist. Older and more woody plants assume a sickly, weak, yellowish appearance, wilt at the top, and slowly die. The roots of affected plants have a characteristic ashen-gray colour. When nearly mature plants are attacked, the grey colour rot may appear down one side of the tap root only. The leaves, side branches, and part of the main stem above this portion die, giving the plant a peculiar one-sided blight appearance. The fungus attacks the plants through the young tissues of the seed, leaves, stem, or root. The disease is spread from one locality to another chiefly through infected seed, particles of soil, dirty implements, etc. Soil centres of infection in the field spread slowly, and usually do not cover the whole field for two to four years, after which the soil is "flax sick," and further crops cannot be grown until after five or six years. No method of soil treatment, except rotation of five years between crops, is known. The disease is usually introduced into the soil through the seed. This can be prevented by sprinkling the thoroughly cleaned seed with a solution of formalin: 1lb. to 45 gallons of water. The solution should be applied evenly and only enough to dampen the surface of the seeds, after which they should be shovelled over and over until dry.

It may be mentioned that linseed meal which is a by-product of the manufacture of the linseed oil from flax seed. It has a beneficial effect on the health and appearance of all farm animals. It may be fed to cows in rations of 8lbs. daily. Horses should receive only occasional feeds of linseed meal. It may be fed to skim-milk calves to replace the fat of the whole milk. The flax seed or linseed, cooked or ground, may be fed to calves and other farm animals; but it contains more oil than linseed meal, and should be fed sparingly on account of its laxative effect.

The yield of flax seed per acre varies from 8 to 15 bushels per acre. The cost of growing and pulling a crop of flax fibre at the Oregon Experimental Station was about £3 per acre; and for ploughing, harrowing, and sowing the seed, 6s. 6d. per acre.

BORDEAUX MIXTURE OR BURGUNDY MIXTURE.

By A. Despeissis.

The amount of success which the substitution of heavy lubricating mineral oil has had in the preparation of an emulsion for the more ethereal, rectified petroleum suggests yet other improvements in the preparation of our orchard and crop washes and sprays.

In America, in Tasmania, and more recently in Western Australia, great success has been achieved in fighting plant scales and lice by means of these heavy oil emulsions, which from the name of one of the constituent ingredients used is known to orchardists as "vacuum oil emulsion."

In these notes I take the opportunity of pointing out the marked improvement in the preparation of "Bordeaux Mixture" for fighting fungoid diseases as the "vacuum oil emulsion" has proved in fighting insect pests on trees during their dormant period.

The formula for Bordeaux Mixture, it is well known, consists of sulphate of copper or bluestone in proportions varying from 2lb. to 6lb. per 100 litres or 22 gallons of wash. To the sulphate of copper a sufficient amount of quick lime, recently slaked, is added to neutralise the first-named chemical.

After dissolving the copper salt in a few gallons of water, and after mixing the lime with also a few gallons of water in a separate vessel, the two component ingredients are poured slowly into a vessel containing enough water to make up with that used in dissolving the copper sulphate and the lime 22 gallons of mixture.

The result is a fine, impalpable, bluish precipitate, chemically known as hydrated oxide of copper. Although very fine and light, that substance gradually settles down in the liquid, and for that reason it is necessary to stir up the mixture when about to be used.

That hydrated oxide of copper is itself insoluble, but is gradually dissolved by rain water or dew containing even traces of carbonic acid or of ammonia. It is also dissolved by the acidulate moistness of growing fungus roots or tissues, which they kill on contact.

Wherever quicklime of a good quality can be procured at a low price, Bordeaux mixture is the cheapest and one of the best fungicide washes we can use for subjugating some of the most disastrous of our orchard and crop pests.

With us, however, in Western Australia, I have on occasions seen much harm, through leaf-burning, follow up its application, and it is also hard on spray pumps. This is due to a combination of two causes: Our lime, excellent as it is for building purposes, contains a heavy proportion of sand. That sand is at the same time an inert matter during the chemical reaction which is set up when sulphate of copper in solution is mixed with it. It follows that the grower who prepares his wash in accordance with the formula of Bordeaux Mixture—which is found in every text book dealing with plant diseases, in which the quantity of each substance used is accurately defined—unwittingly prepares a wash which at times adds injury to the crop he wants to spray. That injury is caused by the caustic effect of soluble sulphate of copper, even in minute quantities, on leaf tissues. Another injury is also caused by the impure lime we have to use, and that is to the spray pump itself. The sand-grit in the lime scratches and spoils the valves and organs of the delicate spraying pumps and reduces or destroys their capacity for the work they are intended to do. It is possible, of course, when we know what causes the damage, to supplement the quantity of the quicklime, or to strain the grit out of it; but this does not appeal to the average orchardist or the gardener pushed for time. Besides, he may only require using Bordeaux Mixture but once or twice a year, and just when he wants it he may not have any quicklime on the place. That means putting off dressing the diseased crop until a fresh bag has been procured, sometimes from some distance. On too many occasions it means that no spraying at all is done, and the disease is allowed to run out its course or to destroy the crop.

Burgundy Mixture.

For the reasons set out, I would recommend as a substitute for Bordeaux Mixture another preparation which also first emanated from one of the most noted vine-growing districts of France, and which is every day becoming more popular. As the *Bouillie Bordelaise* got its name for having first been used about the Médoc, which lies in the vicinity of Bordeaux, so the *Bouillie Bourguignonne* is named for having been first used in the Burgundy district of France.

Its preparation is simpler than that of Bordeaux Mixture, and for us in Western Australia, where quicklime is impure, expensive, and not readily procurable, it is strongly to be recommended.

The formula of Burgundy Mixture is:—

Sulphate of copper (bluestone)	4lbs.
Carbonate of soda (washing soda)	5lbs.
Water	22 gallons.

The *modus operandi* is as follows:—

Each chemical is dissolved separately in one gallon of warm water. When cool pour gradually the washing soda solution into 20 gallons of water, stirring all the while. To this add in a small stream the sulphate of copper solution, without stopping the stirring. A gelatinous greenish-blue precipitate is formed, which is hydrocarbonate of copper. The action of this chemical towards parasitic fungi is the same as that of the hydrated oxide of copper of Bordeaux Mixture. It presents other advantages: it sticks better to the leaves, it is slower in settling, and an occasional stirring keeps it longer in suspension.

The composition of washing soda is more uniform than that of lime, and it is therefore safer to implicitly follow the formula. Besides, a pound or two of washing soda is always found at any time in any household, as it can be readily procured from the nearest grocer. This does not scratch, wear, or choke spray pumps as Bordeaux Mixture does.

The adhesiveness of this spray is strengthened by the addition to the chemicals named above of ½lb. of molasses or of brown sugar after the greenish-blue precipitate has formed. The mixture then turns dark green, and the precipitate is light and very adhesive. The dissolved part acts at once on being used, the precipitated portion lengthens the period of action and is gradually dissolved by rain, dew, and moist air.

For use on citrus trees the addition of a little soap causes the mixture to stick better to the glossy leaves.

After having seen in France thousands of acres of vineyards treated, although the formula given above is one for making 100 litres or 22 gallons of the mixture, it stands to reason that where a small quantity only is required the proportion can be reduced to suit the amount required. Thus, where a few rose bushes only have to be dressed, a quart or two of the copper spray may be all that is needed, and that the formula for that mixture may be brought down to—

Bluestone	1oz.
Washing soda	1¼oz.
Water	2 quarts

by means of this mixture as a preventive against mildew, I have since used it in the treatment of curl leaf and shothole of stone of fruit and of potato-leaf blight, with the best results.

In every case where Bordeaux Mixture is prescribed, Burgundy Mixture will act as well.

Testing Copper Spray Mixtures.

In making either Bordeaux or Burgundy Mixture, a formula is followed.

It is evident, however, that owing to difference in the strength and the degree of purity of the ingredients used, the resulting mixture may at times cause injury to the foliage. If the sulphate of copper has not all been taken up by the alkalies lime or soda, the unprecipitated portion may burn the tender leaves; if, on the other hand, excess of lime has been used the adhesiveness of the mixture is impaired, and on this account the protection against disease to leaves and fruit not so lasting.

It is desirable for these reasons to so balance the amount of copper sulphate and of lime or soda that there is no excess of either ingredient but just enough to bring about the desired chemical combination.

Several reactives offer in this respect a clear indication to the operator as to whether his weights are correct or his chemicals pure enough. For instance, a few drops of a strong solution of yellow prussiate of potash (ferrocyanide of potassium) added to the spray liquid will instantly colour it *black* if there is an excess of copper, and will indicate the necessary addition of lime. No change of colour, on the other hand, shows that there is a sufficiency of lime or of soda. Some plunge a clean blade of a knife or a new nail into the liquid for a minute or so; if copper is deposited on the steel, lime must be added.

Testing papers, however, are specially useful as a guide to the operator.

Of these, two are particularly useful: the *litmus* paper and the *phenolphtalein* paper. Any chemist will supply these, or they may be manufactured at home.

After what has been said in the previous paragraphs, it is evident that what one must aim at is a neutral spraying mixture; that is to say, one which is neither alkaline nor acid.

Two pieces of litmus paper, one blue and one red, dipped into such a solution, will show no change of colour. On the other hand, if a piece of blue litmus paper turns red, or a piece of red litmus paper turns blue, it is evident that in the first case the mixture is acid and contains too much sulphate of copper, and a sufficient quantity of lime or of washing soda must be added, until the liquid does not affect the blue paper; in the second case, the red litmus paper turning blue indicates an excess of lime or of soda, and that excess may impair the adhesive property of the spray.

Of late years another test paper has been used with good results; it is the *phenolphtalein* test.

To all appearances that paper is just like a strip of white blotting paper. A piece of it dipped in a copper sulphate solution remains white. Another piece, on the other hand, dipped in milk of lime, at once turns blood red.

Now if a small quantity of that milk of lime is added to the bluestone solution, some of the copper sulphate will combine with it and a blue precipitate will form. Into this liquid a piece of phenolphtalein paper dipped still remains white; if, however, more milk of lime is carefully and gradually added and the mixture stirred up until the paper turns *pink*, the addition of the alkaline solution can be stopped, the mixture is neutral; more lime or soda added will cause the paper to colour *red*, which will show that the mixture is decidedly alkaline.

The manufacture of the phenolphtalein paper is simplicity itself—

Alcohol	1 quart
Phenolphtaleine	½ ounce

Methylated spirit will do, and will cheapen the cost. Cut a few sheets of white filtering paper into large strips; dip them into the alcoholic solution. When dry cut up these large strips into smaller ones and fasten together into small booklets for the sake of convenience.

The use of these test papers, it is seen, removes from the preparation of copper spray mixtures the element of empiricism that pervaded it. Without the help of some reliable test the most punctilious operator is simply fumbling in the dark. With some such assistance as those indicated, any farm labourer can be trusted to make either Bordeaux or Burgundy Mixture with as much accuracy as any certificated chemist could.

In fact, a few booklets of test papers in the fruit-shed can dispense with the use of scales and weights altogether and the formula for either Bordeaux Mixture or Burgundy Mixture can be simplified as follows:—

Sulphate of copper	4lbs.
Quicklime, or washing soda, sufficient to neutralise.	
Water	22 gallons.

During a recent tour through the vine-growing departments of France, I have several times come across vignerons making copper spray washes to protect their vines against attacks of "mildew," when apparently no heed was taken to weigh either the lime or the soda, the final adjustment of either of these ingredients with the bluestone, weighed packets of which they provide themselves with, being arrived at by means of either of the test papers mentioned in these notes.

The spraying season is now at hand, and I have no doubt that those who prepare their copper spray washes with due regard to the complete chemical reaction of the ingredients, will both add to their efficacy and avoid the possibility of any damage being done on account of the burning effect of the copper salt on the foliage.

On application I shall be glad to post some phenolphtalein test paper to those desirous of using it in connection with the manufacture of their copper spray mixtures.

A FEW NOTES ON ORCHARD MANURING.

To make an orchard pay and to produce first-class fruit it is necessary to have only healthy and well-nourished trees, which will then grow perfect fruit. To obtain this result, let us consider what do plants and fruit trees feed on.

From the composition of soils and plants it will be seen that there is everything in the soil that is in the plant, yet it must not be taken for granted that the plant takes everything from the soil. Carbon, which forms the wood, is partly absorbed by the plant from the air, and partly from the soil; but with this exception the plant gets all its food from the soil. If the soil does not contain all of these or contains them only in small quantities, they must be put in in the form of manure, else if there is insufficiency of any one element the plant becomes unhealthy. Most of the chemicals are in the soil in great abundance, but the few that are absorbed in greatest quantity are not abundant enough. These are nitrogen, potash, lime, and phosphoric acid. Phosphoric acid almost invariably begins to fail first, for most soils contain more nitrogen and potash than they do phosphoric acid; next nitrogen fails, and finally potash and lime. These are the four substances about which we must concern ourselves in manuring.

We can dispose of lime at once, as it is not possible to supply phosphoric acid without at the same time supplying lime.

Nitrogen is obtainable from sulphate of ammonia, nitrate of soda, dried blood, dried offal, bonedust, stable and farm-yard manure.

Phosphoric acid is obtainable in superphosphates, Thomas' phosphate, bone-dust, guano, and stable or farm-yard manure. In superphosphates it is in the most readily available form; while in guano, bonedust, and Thomas' phosphate, it is in an insoluble, or only partially soluble form; in farm-yard and stable manure it is contained in comparatively small proportions.

Potash is obtainable in muriate of potash, sulphate of potash, nitrate of potash, and kainit, and in small quantities in farm-yard manure.

Many farmers and fruitgrowers pin their faith on farm-yard manure. If they use this they should mix superphosphate with it, as it has not got a sufficient amount of phosphoric acid in it.

A good manure for fruit trees is:—

> $2\frac{1}{2}$cwt. per acre sulphate of ammonia, or 3cwt. nitrate of soda; 4cwt. per acre superphosphate; $\frac{2}{3}$cwt. per acre potash salt.

Instead of putting nitrogen in the soil in the form of sulphate of ammonia it is considered a better plan to supply it by green manuring.

Green manuring is specially valuable because by the aid of bacteria contained in the nodules on their roots they are able to build up nitrogenous compounds, when therefore any plant of the leguminous family, such as peas,

beans, clover, lupines, etc., has been grown for green manuring it not only enriches the soil in organic matter, with all its attendant benefits, but also leaves in a more readily available form the elements of fertility.

It is, of course, necessary when sowing green manuring to feed them in their turn; although they take their nitrogen from the air, they must have prosphoric acid and potash, through a good dressing of chemical manure made up as follows:—

3cwt. superphosphate and 1cwt. muriate of potash per acre.

Experience shows that muriate of potash is the better form of potash for crops grown for green manuring, but sulphate of potash has proved to be the better form for fruit trees, as it exercises a very beneficial effect in the flavour of the fruit.

Green manuring should be cut in blossoming time and ploughed or dug in round the fruit trees, or even laid on the ground round the stems as a mulching. If the green crop is cut and fed it removes a large proportion of valuable matter from the soil.

Serious injury to the trees may be done by improper application of manures; they should be supplied in as soluble a form as possible in the rainy season before the fresh growth takes place. It is advisable that the manures should get down to a considerable depth, and therefore the greatest solubility should be preferred. The most soluble manures are sulphate of ammonia, nitrate of soda, sulphate of muriate of potash, and superphosphate.

Bone-dust only reaches the deep roots very slowly; so does Thomas' phosphate.

A good method of manuring fruit trees is to dig one to four holes round the tree, according to its age, about two or two and a half feet deep and putting the manure in the holes. The holes should be dug in different places each year, and by this method the roots get the benefit at once, and the growth of weeds is not encouraged as from surface manuring.

When trees have been neglected it is a good thing to remove four to six inches of the top soil over all the roots, and to replace it by new material made up of farm-yard manure, dead leaves, light sandy soil, with some superphosphate mixed with it.

This material should be put on thicker than that which was removed to allow for settling. This is done at the same time as the pruning of the tree and roots.—*The Fruit World.*

DISTRICT NOTES.

PINGELLY DISTRICT.

Report by Inspector NAPTHALI.

During the past month I have travelled over a large area of the above district, and in every direction that one travels, evidence of new settlement is noticeable.

Of the holdings visited during the past nine months, 114 were on account of Agricultural Bank loans, which had been obtained principally for clearing for the cultivation of cereals, and I am pleased to state that the settlers are faithfully carrying out the conditions of the loan. General contentment seems to exist all round.

It is admitted by the settlers that the assistance given to them by the Agricultural Bank to enable them to clear, together with the liberal land policy of the State, enables them, even at a distance of from 30 to 40 miles from the railway line, to make a good living.

In and around Popanning Pool increased settlement is going on, and a substantial increase of cereals will be harvested from present crops. The locality is attracting considerable attention, a number of new settlers from the Eastern States having taken up land and started work.

SETTLEMENT ON THE EASTERN LINE.

Report of Inspector E. H. GLIDDON.

In travelling from Kellerberrin to Burracoppin and from thence on for some thirty miles, I was much struck with the large area of splendid land available for settlement and well adapted for mixed farming.

A large number of settlers are already located in the district, and everything has an air of prosperity. Around Kellerberrin quite two-thirds of the settlers are South Australians. The inquiry for land is increasing and a very large and close settlement is taking place.

All the crops are looking well, with promise of a splendid harvest.

In the district known as the sand plain country, which, as a matter of fact, consists of most fertile forest country, in patches of 300 to 1,000 acres each, the settlers are doing well, and one all are contented and happy.

One settlement I visited, that of Mr. J. H. Moore, 170 acres were under crop—five acres of oats, 10 acres of barley, and 155 acres of wheat. The latter crop looked particularly well. The wheat crop is the largest yet tried in the district, and the result is being keenly watched by all the surrounding farmers.

The only regrettable feature noticed in the whole of my travels was the want of stock. With abundance of good feed everywhere, this should not be, and farmers are neglecting their own interests by not attending to this important matter.

BROOMEHILL DISTRICT.

From Report of Inspector Taylor.

The more I see of this magnificent agricultural and pastoral belt of country, the more impressed am I that the sooner a light line of railway is constructed from Broomehill eastwards for about 30 miles, in order to tap this belt of country, the better it will be not only for those already on the land, but also in order to encourage additional settlement. There is abundance of good land, which extends over 30 miles further east, and available for selection.

Having been all over the agricultural parts of this State, I have not the slightest hesitation in saying that there is no finer stretch of country than that in this district, and it is bound eventually to be the granary of W.A.

YORK DISTRICT.

From Report of Inspector More.

Pastures in the York district show a fine growth of herbage, and it is a pity that more of the settlers do not keep a few ewes—that would materially assist in augmenting the farmers' incomes during the time they are clearing their holdings.

The crops that were sown early have made splendid headway, and are looking really well. Those sown later, however, are not stooling so well; some of the late fields are scarcely more than up, and the fact is settlers are clearing land at such a rate that implement plants are constantly becoming inadequate, and either all the new land cannot be sown, or else seeding operations drag along wearily and laboriously, with the result that such questions as the thorough preparation of the soil or sowing at a propitious time have to be almost ignored.

BROOKTON DISTRICT.

From the Report of Inspector P. E. Dobbie.

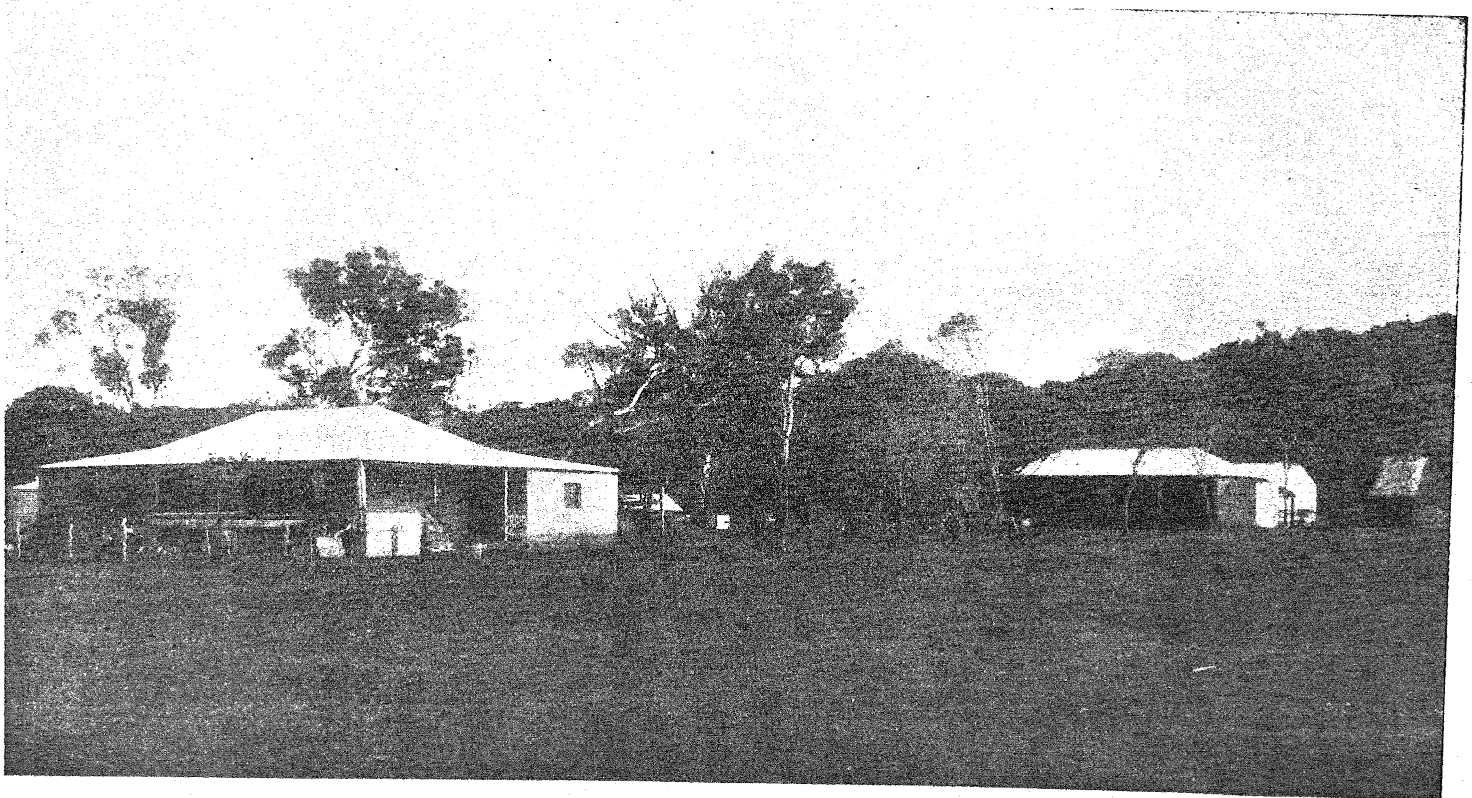
A number of new selectors have arrived in this district recently—one party from America, some from England, and several from South Australia.

Clearing has been general all round, and many additional hundreds of acres are under crop this season. One settler, Mr. A. Page, who has only been in the district 12 months, has 60 acres under crop, which is looking very well.

Another good feature is the increase in the number of sheep being kept. The lambing so far has been very satisfactory. A number of fine horses have also been imported into the district, chiefly from South Australia; but, so far, very few dairy cattle are in evidence. A number of very comfortable residences have been erected, the majority of settlers being married men, and have their families with them.

The Agricultural Bank has been of incalculable service to many of the selectors. Many cases where the ground, which now boasts substantial buildings, fencing, orchard, stock and crop, would have been abandoned but for the assistance of the bank.

The progress of the district for the past 12 months has been extraordinary. One cannot go far without passing a dwelling or some substantial



COONDLE.
J. McCluney's Farm. A Modern Homestead.

sign of settlement. Stock-bells are heard and horses and sheep are encountered all through the district, where a year ago the silence of the virgin bush reigned supreme.

COONDLE DISTRICT.

Report by Inspector C. E. May,

Comprising an area of 8,800 acres, lying between two and seven miles north of Newcastle, embraces country of a somewhat precipitous nature, the hills being clothed in luxuriant pasture, whilst the valleys contain splendid alluvial flats, well adapted for intense culture. When the Government of the day was negotiating the purchase of this estate there was a diversity of opinion as to the policy of securing this hilly class of country for closer settlement. The facts related hereunder will confirm the wisdom of the acquisition of the land (which was formerly used as a mere sheep walk) and prove the unqualified success of the purchase for solid settlement.

The area was subdivided into 90 lots, varying from 15 to 37 acres, along the Toodyay Brook to 410 acres of the hilly country, and thrown open for selection about seven years ago. There was keen competition for some of the lots, whilst others remained vacant for some little time after the lands were open for selection. To-day, however, there is not a vacant block, the whole area being occupied by 32 selectors, and, with the exception of one case (a 100-acre block), there is not a holding that has not been improved. Although the settlers—sturdy-looking farmers of the right grit—appear to be using their best efforts in developing their holdings, it is nevertheless noticeable that they do not compare too favourably for high-class cultivation, which is essential for the best results of their products and which is seen to advantage by the settlers on similar areas higher up the river (Avon).

The attention of the Coondle settler is confined almost entirely to the growth of cereals, and yet, in my opinion, the land offers excellent opportunities for mixed farming. Fruit and all kinds of rooted crops, together with the raising of stock and poultry, could be successfully and more profitably undertaken than under existing conditions, where a fair return from the land is not realised by the mere production of one commodity. There are some capable farmers at Coondle, who have executed great work in a short space of time with the heavy jam and York gum country, the foremost being J. McCluney, who has 90 acres under cultivation, a substantial dwelling, and outbuildings. A. Cook has about eight acres of orchard and vineyard and about 20 acres under cultivation and an apiary containing over 200 hives (he has also another one at Muchea, on the Midland Railway). Mr. Cook informed me that his apiary was far more profitable than corn growing. He estimated that his hives average 60lbs. of honey per season, and at present, in a glutted market, is worth £25 per ton, or about 2¾d. a pound. On the day of my visit he had some 600-gal. tanks full of honey, containing in all 13 tons, ready for a favourable market. C. J. Ferguson, of the old Coondle homestead, has 220 acres under cultivation. D. E. and J. A. Lloyd, B. Pember, Lee, and others have made good progress.

The improvements may be summarised as follows:—Boundary fencing (sheep and cattle proof), 66 miles; division fencing, 8¾ miles; area under cultivation, 1,800 acres; other improvements (dwellings, wells, etc.), £3,065; making a total assessment of £9,519, or a rate of 21s. 7d. per acre.

NORMAN ESTATE.

Report by the Chief Inspector of Lands.

Adjoins Coondle on the East, about six miles from Newcastle—this property contains about 6,900 acres, and was acquired from a lady living in England. In October, 1900, the land, which was subdivided into 43 lots ranging from 100 to 290 acres, was thrown open for selection—29 selectors have secured the whole. Norman is better adapted for cereals than Coondle, owing to the country being less mountainous, and the soil of a more loamy nature. By intelligent farming, Norman should yield grain, for quality and average per acre equal to any of the agricultural districts. Owing to the comparative infancy of the farms, the holders are not able, or do not, go in for fallow. In other districts it has proved more profitable to drill half the area in order to leave the other half in fallow than to drill the whole in poorly-worked land. Those who have effected good work may be mentioned—Mr. Cook, who has roughly 400 accres under the plough, two miles of rabbit-proof fencing and other improvements. E. G. Hasson has about 310 acres under cultivation, 650 acres ringbarked, and a neat little home and stables, etc. S. W. Reidy, R. and G. Jeffery, and others are likewise endeavouring to benefit themselves by denuding the land of its timber and bring it under cultivation. In the aggregate the following improvements have been completed, viz.:—Boundary fencing (sheep and cattle proof), 42½ miles; division fencing, 11 miles; area under cultivation, 3,600 acres; buildings, etc., £1,450. A total valuation of £6,460, or a rate per acre of 18s. 9d.

WAROONA DISTRICT.

Mr. S. Whittaker, Inspector of Lands, Waroona.

Three or four years ago Mr. J. N. Cox, of Athgairan, Murray River, East Coolup. commenced making muscatel raisins of the straggling or blemished bunches of his grape crop in order to utilise a bye-product of the vineyard. The raisins, which were sun dried on the roofs of Athgairan, were of similiar flavor to imported dessert raisins, and were appreciated by private buyers for cooking purposes, but were unsaleable in the open market on account of their appearance.

Last season, in order to avoid low prices for a surplus grape crop, Mr. Cox decided to make dessert raisins. For drying he selected the largest and choicest bunches of grapes and placed them in 200 trays, each holding 50lbs. The trays had banksia laths and jarrah sides. The main crop was successfully dried in the sun, in spite of some unpropitious weather, and the balance finished in a kiln. The raisins found admirers but no buyers among the trade, because they were not as attractively packed as the imported article.

All admitted, Mr. Cox says, that his raisins were equal to those of California and Mildura and second only to Malaga, yet the boxes must be made to look pretty to recommend the contents to the public. There must be embroided paper, a case of a certain make and shape, and a picture label or the raisins were no good. The case and its dressing deducted about twopence half-penny per lb. from the grower's profit.

The result of his first season's preparation of table raisins has proved, Mr. Cox added, that he can make a superior article, but it remains to be seen

whether, in the face of heavy expense, he can market that article at a profit. He is hoping that a price that does not allow a profit on the conversion of grapes into raisins may indirectly pay in preventing gluts and low prices for the supply of fresh fruit. The one point that he has so far satisfactorily demonstrated is that having grown the grapes he will lose less by making raisins out of a portion of the crop than by attempting to force the whole crop into the table grape market. At one time he anticipated a market for raisins in England, but on inquiry has elicited that under present circumstances Australian raisins cannot be profitably sold when competing with European and Asiatic cheap labour.

VICTORIA PLAINS DISTRICT.

Report by Inspector Thompson.

During the month I have been inspecting in the Victoria district, of which Geraldton is the chief centre, and from which three main roads emerge and act as feeders to that solid and old-established town.

Although Geraldton compares very favourably with any other agricultural town in the State, still the wonder is that it is not much larger, for it has country within a radius of 50 miles second to none in Australasia, and which supports a large farming population, and it could support a very much larger were it not for the fact that a large proportion of these lands are held by a few persons, who, luckily for themselves, secured large areas in the early days of the State, and now use them for

Pastoral Purposes Only.

There are so many of these fine station properties within a day's drive of Geraldton that I have not had an opportunity of paying a visit to all, but the few I have seen when travelling through the paddocks on my way to inspect the agricultural areas and to make urgent inspections show that the station-holders have improved and are still improving these properties by ringbarking, tank, and well-sinking, fencing, etc., and there is no doubt this district cannot be beaten anywhere for the fine class of sheep it produces.

That ringbarking greatly improves the value of the land for grazing purposes can be seen by a visit to the improved properties on the Mount Erin Estate recently purchased by the Government. Some of the new settlers on this area have ringbarked their holdings, and the growth of the grasses on these lands is magnificent, while outside the paddocks the grass is "backward." When travelling through this splendid estate on my way to the Chapman area I was greatly pleased with the look of the ploughed fields, and given anything like a good season the new settlers can look forward for

A 20-Bushel Crop.

Water is not any drawback to the new settler on this area, as is the case in some portions of this district, for good water can be struck at a comparatively shallow depth.

The Chapman agricultural area adjoins Mount Erin Estate on the north. This also is a fine belt of country, but I had not an opportunity of going all over it, as my instructions were to re-value the vacant blocks, and as these were situated on the south-east portion of the area I only visited that portion. I will, therefore, defer giving a general description until a future occasion. A peculiar feature of this district is that the "good" country runs in belts, and outside these belts is the frequent occurrence of

what is locally known as sandplains. There are three kinds of these sandplains. Some are sand, and nothing but sand; others are hard, gravelly, and stony; while some are composed of a very fair loamy soil, with a good sub-soil. These "plains" are covered with low scrub and other herbage, especially a scrub called "cararra," which the sheep are especially fond of. A new settler in this district, who is going in largely for clearing, etc., informed me that he does not intend to cut down more of these and other shrubs than he can possibly help, for he has found out their value for grazing purposes, as his

Sheep Have Done Better

in the scrub paddocks where there is grass than in the grass paddocks where there is no scrub. I have noticed in all the paddocks I have travelled through that the station-holders had fenced in out of their pastoral leases, a fairly large proportion of sandplain country was included, and I presume that they also knew the value of these shrubs which grow on them.

The little I saw of the Chapman area convinced me that it was admirably adapted for fruit-growing, and now that a few settlers have made a start by planting orchards, orangeries, etc., more will be heard of that industry.

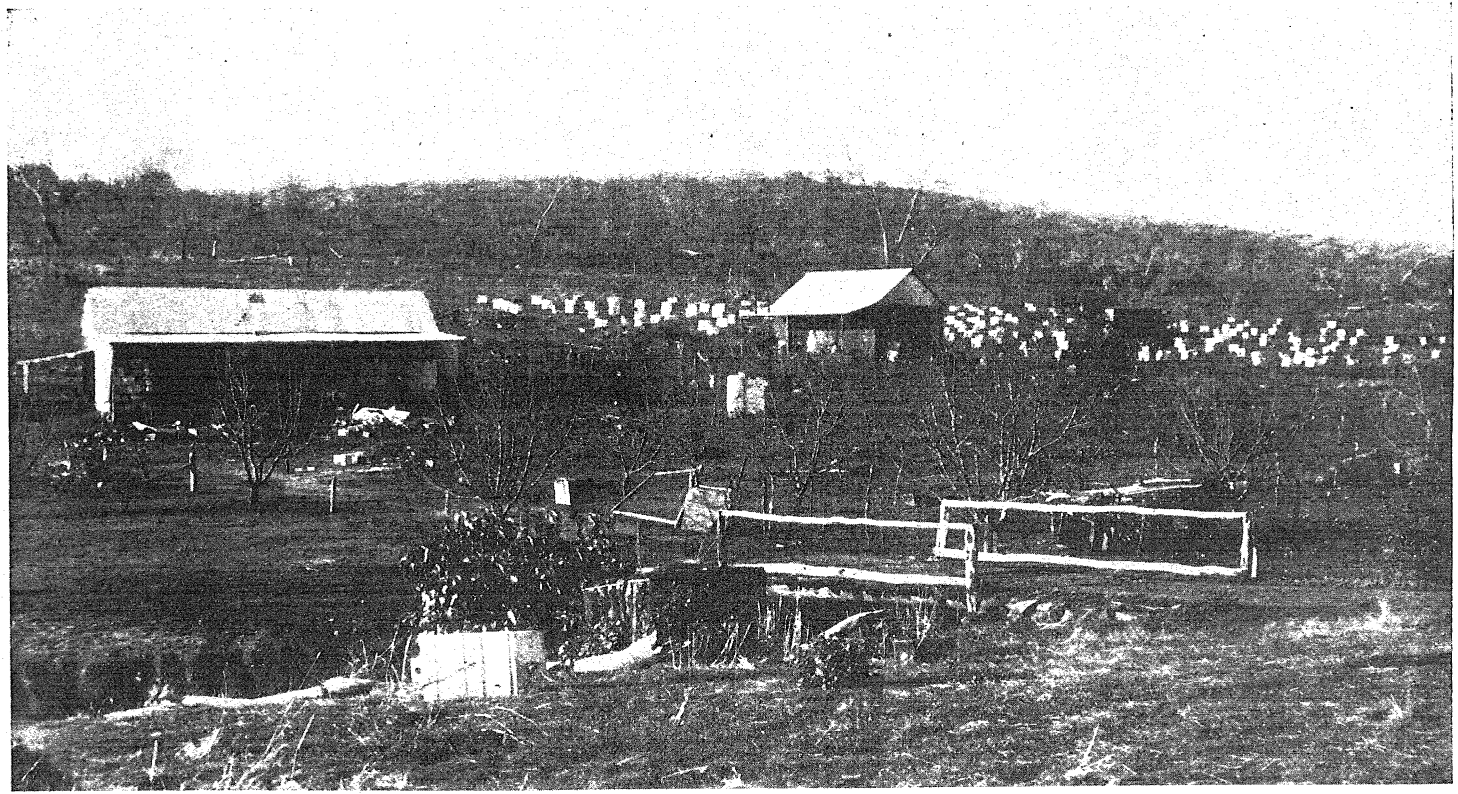
I cannot understand why the land in this district has been neglected by the new settler, for no doubt it has not been looked at. It may be that it is too far from Perth. It is not because it will not grow wheat, for some of the best wheat I have ever seen was being sown by a settler who purchased it from the Experimental Farm on the Chapman area. This Farm is undoubtedly doing good work in this district, for whenever one sees an extra good breed of pigs or poultry, or samples of seed wheat, oats, or barley, etc., and asks where they were obtained the answer is always the Experimental Farm. Besides, a good many have their little patch of rape, lucerne, or artificial grasses, the seed of which was obtained at the same place.

NOTES ON THE EXPERIMENTAL FARM, NARROGIN.

By Frank L. Faulkner.

During the past month we have experienced some nice warm weather, only 187 points of rain being recorded, the most of which fell early in the month. The frosts, however, have been so bad that all except the early sown crops have been checked to a very serious extent, and consequently are still very backward. Altogether 14 frosts were registered during the month, and these happened almost consecutively. The lowest reading was 24° F.

Notwithstanding the backward condition of all crops and grass, the stock on the farm are all in good strong condition, and are improving. Seven cows in milk are doing very well, but are still receiving a little bran and chaff whilst being milked. We are now selling a considerable quantity of butter, which is much appreciated by the townspeople.



COONDLE.

A. Cook's Farm. Apiary in Background.

The ewes with lambs are improving, and the lambs and young sheep are all looking very well; 75 to 76 per cent. of lambs have been tailed. The low percentage was due mainly to the large proportion of young ewes used. The fatalities through lambing, however, have been practically *nil*, although one or two lambs were taken by hawks. Many complaints are coming to hand of trouble with the blow-flies. On the farm up to date we have had only one ewe affected. This is due to the fact that all our ewes were carefully sprayed round the hind-quarters with a solution of sheep-dip just before lambing commenced. A few ewes that have been running on the rape, and that scoured a little, were cleaned and the operation repeated on them for the sake of safety. The pigs have been the source of our meat supply for some time past. We have still about 45 on hand, but they are mostly breeders, suckers, and small weaners. Having sold the major part of our wheat crop as seed wheat we will have scarcely enough grain left to carry us through the season. The majority of the pigs, however, are being grazed and receiving only a little grain.

As regards cropping, cultivation, and fallowing, we have been unable to do a great deal more during the month, as the boggy land left over and not utilised for wheat is still as bad almost as it was a month ago. However, we have managed to get another 13 acres cleared during the month, eight acres of which have been well prepared and sown to a varied assortment of grasses. This piece of land is of a sandy loam nature and keeps fairly moist, and is, I consider, one of the most suitable pieces on the farm for summer fodder crops and perennial grasses.

Right to the end of this month we have held off the potato planting on account of the frosty nature of the weather; but as a certain risk must be taken with potatoes in this district we started planting with the close of the month. Firstly we are sowing a plot of one-tenth of an acre of each of 13 of the best varieties procurable. Each of these varieties will be treated identically as regards land and manuring. Next to these, and also on a nice even piece of land well prepared, will be sown a test of various mixtures of manures. Altogether we shall sow about three acres of potatoes.

The pruning of the fruit trees and vines and filling in of the spaces missed last season has been completed, although part of the vineyard is still so boggy as to be unworkable. This patch will give scope for showing the effect of under-drainage for next winter. Some of the fruit trees are bursting into leaf.

In the vegetable garden things are more forward than most other vegetation, and we are having a plentiful supply of cabbage, cauliflowers, turnips, lettuce, rhubarb, etc.

The field peas sown last month and the month before are doing very well, although in several very wet patches the seeds have apparently rotted before germinating. So far the experiments with nitrogen bacteria conducted on the peas is showing no beneficial result, the untreated being to all appearances as good as the plot treated with the bacteria.

Vetches are not growing as well as the peas, and one acre of thousand-head kale drilled in is coming on very slowly.

Of the grasses sown, cocksfoot of the seeds is the only one that is germinating well up to date. The grasses set out from roots, of which we have several acres, have scarcely made a start yet.

Lucerne is germinating well and strong.

With the wheat test plots, which were sown in June, rather late, the early varieties are running ahead of the later maturing sorts. With oats we have two very promising varieties in "Golden Fleece" and "White Siberian."

In the manure test plots all plots not receiving phosphatic dressing of some description are rapidly falling behind; while those plots receiving nitrogenous and potassic dressings show no beneficial result from its application, even when used with the phosphatic manures.

In the test of quantities of manures used 56lbs. of superphosphate is decidedly superior to the "no manure" plot; 112lbs. per acre also shows a decided superiority over the 56lbs. dressing; but 2cwt. to the acre, while looking rather better than the 1cwt. dressing, does not show such a decided difference.

Regarding the forms of phosphate—the soluble superphosphate is showing results far superior to any of the less soluble phosphates. The less soluble phosphates may be placed in the following order as regards merit: bone-dust, Thomas' phosphate, and phosphatic guano.

The barley sown this season has the double disadvantage of being on very poor sandy land as well as it being stubble. It has consequently done very little, but it is stooling and establishing itself, and will no doubt show better shortly.

NOTES ON THE CHAPMAN EXPERIMENTAL FARM.

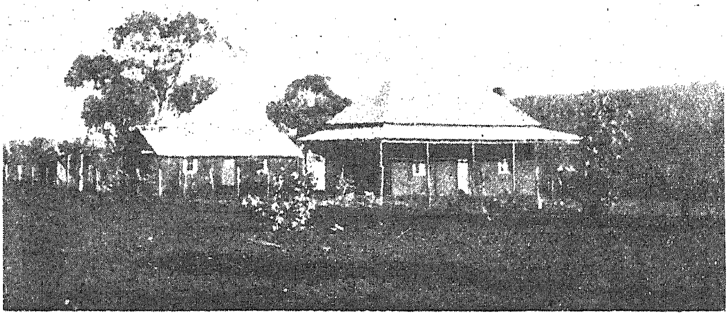
By R. C. Baird.

Owing to the number of buildings erected during the past year, which necessitated the use of the horse teams in carting building material, farm work was much interfered with. The carrying out of experiments—which should be most important here—was also curtailed from the same cause. I trust, now that the greater portion of the buildings required have been erected, that we shall be able to devote more attention to the farm work.

Students.

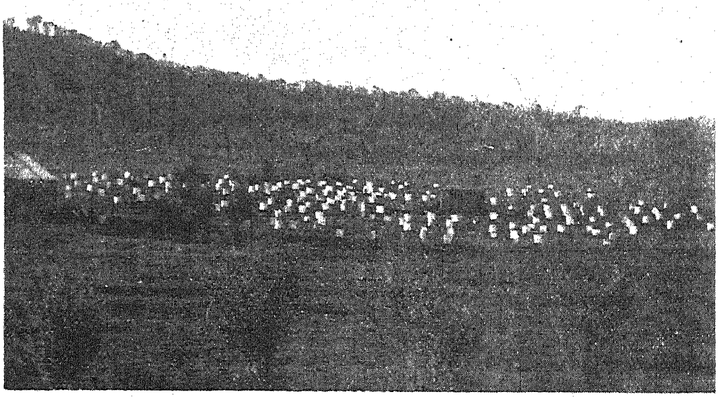
During the year nine students have been in residence. With regard to the general conduct of the students, and the interest they have taken in their work, I am pleased to be able to speak in favourable terms, as they have always shown a desire to acquire a knowledge of farm work.

Ex-student R. Gill, who was at the farm for nearly twelve months, is now farming in the Northampton district. Ex-student F. Foat, who was at the farm for about nine months, has taken up land on the Upper Chapman, and is now busy fencing and clearing it.



COONDLE.

J. A. Lloyd's Farm. The orthodox Homestead. Constructed of Bats; Iron Roof.



COONDLE.

A. Cook's Apiary.

Visitors.

During the past season a good many farmers and others from the surrounding districts have called for the purpose of inspecting the farm and the various crops. Every Friday the buggy is sent to the Bowes Siding, where visitors are met and brought out to the farm. A good number have availed themselves of this means of visiting the farm. Visitors coming in this way are returned to the siding next day in time to catch the evening train to Geraldton.

New Buildings.

During the year three new dwelling-houses have been erected, also an eight-stall stable and a small dairy. The first building put up was for extra accommodation for students. It comprises two dining-rooms—one for students and one for visitors—kitchen, pantry, bathroom, ten bedrooms, and dining-room for workmen. The building is constructed of wood, and roofed with galvanised iron.

A cottage was built for one of the workmen. It is constructed of sun-dried bricks, with a lean-to of wood, and roofed with iron. It also has a verandah on three sides.

The manager's dwelling has been completed. The four main rooms are built of sun-dried bricks, the walls being hollow. The kitchen, bath-room, and pantry at the rear are built of wood. There is a verandah on three sides of the house, and the whole building is roofed with galvanized iron. The dairy is built of sun-dried bricks, and roofed with galvanized iron. It is a very cool building, and well ventilated. The floor is made of concrete and plastered over to a smooth surface, which greatly facilitates washing out.

The new stable contains seven stalls and one loose-box, and has proved a great convenience. We are now able to stable all our working horses.

Clearing New Land.

One hundred and twenty acres of new land has been cleared for cropping. Most of it is very poor land, while a small proportion is good red loam.

Water Conservation.

At the beginning of the summer a well was sunk in No. 5 paddock. Good water was obtained at a depth of 25 feet. Sinking was continued to a depth of 30 feet. A windmill was erected at this well, and it now supplies two paddocks. With the addition of a few lengths of piping the water can be conveyed across the road to a third paddock.

The well in No. 19 paddock was retimbered and cleaned out. A windmill has since been erected. The supply of water has proved greater than was anticipated. The water here, as at the No. 5 well, is also laid on to three paddocks.

Piggeries.

To accommodate the increasing herd of pigs eight new pens have been erected. The pens are mostly 40 feet by 40 feet, a few being 40 feet by 20 feet. They are enclosed with jam stakes with one rail on top; height 3 feet 6 inches. Shelter-sheds have been erected in the pens. They are built of rough bush timber and thatched with straw.

Fencing.

During the year 60 chains of new fencing has been erected, and wire netting has been put on the fence around Dusty Bank paddock. Some new fencing has been erected around the buildings to take the place of the old temporary fences.

Cropping.

The past season was on the whole a good one for the cereal crops. The rainfall, although rather scant in the latter part of the winter, was all that could be desired during the spring. The late rains brought on all the backward crops, and the yields all round were quite up to the average, the late crops benefiting most.

A block of six acres on the sand plain sown, very late, with Queen's Jubilee wheat was a failure, and in consequence the cattle were allowed to graze it.

Twelve varieties of wheat were grown in the fields in various sized areas. All the varieties were sown alike, the seed-drill being used, placing the grain in drills about seven inches apart and about two inches deep. The manure was applied in the drills with the seed.

Five varieties of oats were grown. The best results were obtained from the Algerian and American Early Ripe varieties.

Garton's B, an English variety, made very vigorous growth during the winter, but when the hot weather set in it dried up and gave a poor return. This variety is too late for this district. Australian Crossbred 23 did very well. The yield was good but the grain rather thin. The Hulless Oat gave a poor return.

Although the harvest returns have been already forwarded to you, I think this report would be incomplete without them.*

Hay-cutting was commenced on October 17th. The weather was stormy, with a heavy rainfall, which greatly retarded the work. The hay, however, was well stooked, and very little damage was sustained.

As we have no means of weighing the hay crop, the result can only be given approximately.

Estimated result of hay crop:—

Variety.	Date sown.	Manure (70lbs. per acre).	Character of soil.	Yield per acre in tons.	Remarks.
WHEATS.					
Sullivan's Early Prolific	May 2 ...	Super., English ...	Medium sandy loam; second crop	1½	Fair quality
Clinch's IXL	May 23	Super., Victorian ...	Light sandy soil; second crop	1	Good quality
Queen's Jubilee	June 28	Super., English ...	Good red loam; second crop	1½	Straw fairly strong; good hay wheat
Majestic ...	June 25	Super., English ...	Good red loam; second crop	1½	Stands up well; good quality hay
OATS.					
Algerian ...	June 30	Super., English ...	Medium red loam; second crop	1½	Fine straw; good quality

The grain crop was harvested during the month of November and the first week in December. It was cut with the binder and threshed with the new tread-power threshing machine.

The area threshed for grain was one hundred and fifty acres, which yielded about 2,500 bushels.

The results being as follows:—

Variety.	Date sown.	Manure, rate per acre.	Character of soil.	Yield per acre.	Remarks.
WHEATS.				bushels.	
Sullivan's Early Prolific	May 21	Abrolhos guano, 70lbs.	Good light loam; second crop	14	Early; weak straw sheds
Silver King	June 2	Super., Victorian, 112lbs.	Good red loam: first crop	12·4	Stands up well; medium early
Rerraf ...	June 2	Super., Victorian, 112lbs.	Good red loam; first crop	10·5	Early; weak straw; grain small
Field Marshal	June 2	Super., Victorian, 112lbs.	Good red loam; first crop	12	Stands up well; medium early
Australian Crossbred 73	June 2	Super., Victorian, 112lbs.	Good red loam; first crop	18	Straw rather weak; good grain
Steinlee ...	June 2	Super., Victorian, 112lbs.	Good red loam; first crop	18	Early; straw weak; good head
Australian Crossbred 1/J	June 2	Super., Victorian, 112lbs.	Good red loam; first crop	12	Early; fair straw
Alpha ...	June 12	Super., Victorian, 112lbs.	Light loam; first crop	16	Early; straw weak; plump grain
Australian Crossbred 77	June 22	Super., Victorian, 112lbs.	Light loam; first crop	13·5	Early; straw rather weak; long grain
Majestic ...	June 25	Super., English, 112lbs.	Rich red loam; second crop	15	Stands up well; good straw; grain small
Jade ...	July 6	Super., English, 112lbs.	Medium red loam; first crop	12	Medium early; stands up well; good grain
OATS.					
Algerian ...	June 30	Super., English, 112lbs.	Good rich loam; second crop	30	Early; suitable for dry districts
American Early Ripe	June 29	Super., English, 112lbs.	Part rich loam, part poor gravel; second crop	20	Early; good yielder
Hulless ...	June 29	Super., English, 112lbs.	Part rich loam, part poor gravel; second crop	8	Grain very thin and light
Australian Crossbred 23	June 29	Super., English, 112lbs.	Medium red loam; second crop	32	Early; good yielder
Garton B...	June 29	Super., English, 112lbs.	Medium red loam; second crop	12	Late; not suitable dry district
BARLEY.					
Cape Barley	July 13	No manure	Good red loam; first crop	21·5	Sown rather late to obtain best results

POTATOES.

Two and a-half acres of potatoes were grown. The variety "Beauty of Hebron" will, I think, suit this district. One acre of this variety was planted early in June on rising ground. They escaped the frost, and did well until attacked by a grub, which committed great damage to the crop. The balance of the potato crop, one and a-half acres, was planted in July,

and gave a return of 25cwt. per acre. The crop at time of planting was manured with special potato manure, applied with the seed in the furrows.

Peas.

Several varieties of garden and field peas were grown. Of the garden varieties "Stratagem" and "Yorkshire Hero" did best. The field peas were rather late sown for this district. Of the "Dunn Grey" and "Blue Prussian" varieties, the former gave the best return.

Turnips.

Turnips sown in June were a good crop. The varieties grown were "Green Top," "Purple Top," "Pomeranian White Globe," and "Magnum Bonum" (Swede).

Summer Crops.

Three acres were planted with "Ninty-day Maize," sown August 24th. Grew vigorously until about three feet in height, when the milch cows were turned on it. The cows ate it ravenously.

Twelve acres sown with "Early Amber Cane" in September made excellent growth, reaching a height of six feet in some places, while the average height was about four feet six inches.

Japanese, Hungarian, Russian, and Egpytian Millets gave very good results. Two acres each of these varieties were sown in the beginning of October. The stock were very fond of this fodder, and put on condition in remarkably quick time. Horses did particularly well on it.

Horses.

The number of horses on the farm are as follows:—

Pure Suffolk mares ...	8
Pure Suffolk stallion	1
Draught mares	8
Hacks	4
Yearlings	2
Two-year-old ...	2
	25

Cattle.

The cattle on the farm are mostly pure Dexters, with a few half-breds.

Pure Dexter cows	9
Pure Dexter bull	1
Half-bred Dexter cows	7
Pure yearling bull ...	1
Pure heifer calves ...	3
Half-bred two-year-old steers	2
Half-bred one-year-old heifers	2
Calves (mixed sexes)	6
	31

Sheep.

Pure Shrop ewes	16	Cross-bred breeding ewes	130
Pure Shrop ewes, 2-tooth	5	Cross-bred ewes, 2-tooth	30
Pure Shrop rams, aged	2		160
Pure Shrop ram, 4-tooth	1		
Pure Shrop ram, 2-tooth	1		
	25		

Pigs.

Berkshire boar	1
Berkshire sows	2
Large black boars	6
Large black sows	6
Ordinary pigs (mixed sexes)	30
	45

Angora Goats.

Bucks, young	2
Bucks, old	2
Does, young	6
Does, aged	17
Wethers	4
	31

Turkeys.

Turkeys bred during the year as under:—

Gobblers, young	55
Hens, young	35
Gobblers, old	3
Hens, old	10
	103

Poultry.

Golden Wyandotte cockerels	9
Golden Wyandotte hens	18
Silver Grey Dorking cocks	4
Silver Grey Dorking hens	28
White Wyandotte cock	1
White Wyandotte hens	4
	64

STATE FARM, HAMEL.

AUGUST REPORT.

By G. F. Berthoud.

Weather.—The past month has been generally fine and seasonable, fair mild days and cold nights, with a few heavy frosts, which damaged some of the early-planted potatoes. Heavy rain fell during the last week in the month, causing the brook to overflow over most of the low land, but without doing any serious damage to growing crops.

Work.—Nearly the whole of the land on this farm is low and swampy. Owing to this drawback field work, such as ploughing and cultivating, has to be postponed until later in spring, when the soil becomes firm enough to carry the team. Some of the best-drained soil has been dug and planted with selected potatoes and other plants.

Crops.—All early-sown and well-drained plots of cereals and grasses are looking well and making fair progress. Those sown later, although healthy, are still very backward, and it will be some weeks yet before good vigorous growth can be expected. The soil on most of these plots is better adapted for the culture of summer than winter crops.

Potatoes.

Towards the end of the month a large plot was planted, comprising a few lately imported sorts, and 186 lots of selected seedlings, raised here last autumn. All the tubers were cut, and any showing signs of disease, or bad keeping quality were rejected. The freshly cut sets were dipped in a powder composed of lime, bluestone and flowers of sulphur, as a preventive against the attacks of injurious fungoid, or insect pests. Taken as a whole, the seedling tubers kept well and were in good condition. Some of the plants are now showing above ground, and look well.

Thorburn's "Noroton Beauty."—A few tubers of this new American variety, were imported direct from the raiser. They reached here on the 18th May in bad condition. Sets were cut to single eyes, and planted that day. Of these only three came up, which produced dwarf, but healthy plants. Taken up on 26th August, yielding a fair lot of medium sized tubers—shape round, very neat and uniform. Colour, creamy white with bright pink eyes. Promising variety, likely to be a valuable addition to the early class. It is a seedling from the old peach blossom.

Seed Distribution.

During the past month numerous applications have been received and dealt with for trial lots of grass-roots, also maize, and other seeds; also queries *re* culture, which have been answered. This branch of the work now takes up a fair share of my time.

Exhibits.

Show-cases to contain samples of the various grains and other produce grown here, are now being prepared for the Royal and National Shows.

BEE NOTES FOR OCTOBER.

SWARMING.

The natural instinct of swarming with which the bees are endowed is a God-given provision for the propagation of their race and its spread over any district which is favourable for their existence. When it is remembered that it is only by means of the queens and drones that the race can be propagated; that these queens and drones cannot exist by themselves, or without the workers of a colony, we then realise what this instinct of swarming means and how beautiful it is adapted to the wants of the race.

With the exception of the district of, and around, Perth, where swarming sometimes commences in August, there is but little difference in the swarming season in this State. From the middle of September till well into February may be said to be the main part of the season.

Natural swarming may occur at any time during these months, as the condition of the colony demand, and according to the season. For profitable working the early swarms are of course much to be preferred, as these have the opportunity to build up, rear brood, and become strong before the opening of the honey flow; whereas those coming later are at a disadvantage, and when the harvest arrives, instead of their being ready to take full advantage of the nectar for storing they have to consume the honey in raising young brood.

Late swarming should not be encouraged by any means, indeed such are of no profit to their owner, and are a sign of carelessness on the part of the bee-keeper, for not only are they as a rule useless in themselves for that season, but they also cause, if not further swarming amongst others, then inconvenience to the apiarist.

While swarming under ordinary conditions may be, and are both wise and profitable, both to the bees and for the apiarist, there are times and often conditions when it can be and should be restrained, if not kept from swarming altogether, and the best assistance we have in this direction are roomy hives, and these well ventilated; at the same time much depends on the knowledge and tact of the bee-keeper, that is, his knowing what to do and how it is to be done and the doing the proper thing at the right time. There are times when almost everything depends on the ability of the bee-keeper to adapt himself to the circumstances of any particular case, when all his reading and all his practical experience fails him and he must fall back on his judgment as being all he can trust to, and if his judgment fails him it may make all the difference in his getting or losing the greater part of his season's crop from that particular colony. Such a time is when the honey season may have been retarded or checked by unfavourable weather, or when just sufficient honey has been gathered to keep up breeding his colonies, and a sudden change to favourable weather, and an extra good honey-flow. Considerable tact is then necessary to prevent the bees from taking the swarming fever.

If done at the right time much may be accomplished in the desired direction by adding a super and giving more room. As while swarming may

be kept down to a great extent in the early part of the season by enlarging the hives in good time before the main honey harvest sets in. But, as already observed, any operations connected with the prevention of swarming require good judgment and foresight on the part of the bee-keeper that he may hit on the right time to perform them.

Clipping Queens.

For the purpose of obviating some of the inconveniences connected with swarming, many leading bee-keepers have adopted the plan of clipping one of the queen's wings after she has become impregnated, thus preventing her joining the swarm on the wing. Many reasons can be given in favour of this method, while only a few, and these not of much account, against it.

When a swarm issues, the clipped queen, although she cannot fly, will make the attempt, and in some cases will get a considerable distance from the hive. The bee-keeper being at hand, must pick her up and cage her. As soon as the bees are out the hive should be removed—preferably turned round so the entrance is in the opposite direction, when an empty hive should be put in place of the old one. This hive should contain frames of comb or foundation. Open the entrance as wide as possible, then lay the cage containing the queen in the entrance, wait till the swarm returns and have settled and are running into the hive, when, if available, place a frame containing eggs and brood in the centre, then relieve the queen, and be careful to see she runs into the hive. Care must be taken to clip every queen in the apiary, for, should two swarms issue at the same time, and one has an unclipped queen, it is more than probable they may join and both make for pastures new.

While if every queen is clipped, should one or more swarms come out at the same time and cluster together, and if the bee-keeper is in touch as he should be with every hive, and is sure there are not any young virgin queens likely to be on the wing, he need not trouble the cluster, as each will return to its own hive, providing the queens have been caged and placed in the entrance of the new hive. Note, whenever this happens, *i.e.*, two swarms have joined in cluster and have returned to their respective hives, it would be advisable to keep the queens caged a little longer, say, till last thing in the evening, when the cork should be taken out of the cage and the cage returned and pushed well into the entrance, leaving her majesty to leave at her leisure; in some cases it would be preferable to fill the entrance of the cage with candy and let the bees eat her out.

There are objections to clipping, which many put forward, that someone must always be on hand to watch for the clipped queen and change the hives. In a large apiary it would be necessary to see the swarm coming out of the hive, otherwise it would be difficult to locate the queen. But while there is some force in this objection, the fact must not be lost sight of that, with the queen cut, should the swarm leave and the queen be lost, the bees will return to the hive again, whereas with an uncut queen, bees and queen may all be lost, so that it is a matter of choice, which each can decide for themselves.

Dividing or Artificial Swarming.

This method, to enable the bee-keeper to control or prevent natural swarming, has of late come very much into vogue, and which, in the hands of a careful bee-keeper, has many distinct advantages, as it obviates the

necessity of watching for natural swarms, and also saves much time, and it further seems to satisfy the bees, and they settle down and give no further trouble.

There are certain conditions which require careful attention. The colony to be dealt with must be strong, there must be plenty of drones flying to fertilise the young queens, the day must be fine, and the brood must be protected from being chilled, and there must be a good honey flow on. All these conditions favourable, provide a hive and fill with combs of worker comb, or full sheets of foundation; place this hive on a new stand close alongside of the old one; prop up the front of this hive an inch or so, and lay a sack across the entrance. Now hunt up the queen and cage her. Then take the frames one at a time and shake or brush off the bees near the entrance of the new hive, into which they will run. After most of the bees have been transferred from the old to the new hive replace the combs again into the old hive, release the queen, and let her run into the new hive. Then close all down. There will then be honey and brud in all stages and hatching every day. Most of the old bees will have returned to the old stand, sufficient to care for the brood. Queen cells should be also found, and if increase is not the object these should be all removed before nine days. By the 21st day all the brood will be hatched, when the old hive should be removed and replaced with the new one containing the queen. The bees in the old hive may now be shaken in front of the new one, or if desired, the hive may be placed on top as a super.

When the old hive contains a lot of good old and seasoned worker combs, they become too valuable to use in the super, as above. In this case, replace them with others, and use these frames in any brood nest where such may be wanted. This should now be a strong colony, and care should be exercised to see that she has plenty of room for storing. If the honey flow is favourable, such a colony should give a good account as honey gatherers.

Don't let your Bees starve.

At no period during the honey season does the bees require more careful attention than in the early spring. They may have been left to winter in the very pink of condition, and have successfully weathered all the storms of wind and rain, and in most cases have an abundance of sealed stores left in their hives, and yet they may be found practically in a state of semi-starvation. My readers will ask why should they starve when there is sealed honey in the hives?

The reason is, that early and bright spring weather, when it continues for several days or a week, encourages the bees to break cluster and the workers to freely fly in search of nectar, pollen, and water; this stimulates the queen, who is induced to commence laying, and in an almost incredible short time every available cell is occupied with eggs, which in due time develop into the larvæ state, and as the stores are consumed and more cells are at the service of the queen, these are quickly occupied also with eggs and larvæ, thus increasing the capacity of the brood nest, and also the continued consumption of stores, to satisfy the wants of the young brood and keep the brood nest up to its normal temperature.

Such weather continuing, all is well, but when we have a sudden change, as we very often have, with rain and stormy weather, followed by cold nights, then with the enlarged brood nest every bee is required to join in cluster and add her quota of heat to assist in covering and keeping warm

the brood, which is found in every stage. A few days would do but little harm, but when a continuance of days and perhaps weeks of wet and stormy weather obtains, when the bees cannot fly and replenish their stores, that within the hive is consumed in such large quantities that it soon gives out, at any rate that within reach of the cluster. At the same time there may be plenty of sealed honey in the hive but out of the reach of the clustering bees, hence not really available in such weather. The adult bees would survive for days, as they often do; but not so the larvæ, they must have food all the time, cold or no cold; without it disease and death naturally follows. A change of weather may find the workers too far reduced and too weak to fly, or even to reach and uncap the sealed stores within the hive, with the result that spring dwindling or some other disaster overtakes an otherwise fairly strong colony.

Hence, coming back to the point at issue, careful and intelligent attention is required, and must be given every spring. Unfortunately for the bee-keeper, such cases as already cited above are only found in hives containing a prolific queen or the best stocks and those we can least afford to be idle a single day when the honey flow comes on; instead these hives are practically crippled for the time, and the only remedy at hand is to feed them, and to feed them liberally and constantly until they have an abundance of stores within sight.

Should the weather be unfavourable for opening the hives, it would be wise to go through the apiary and lift each hive from its stand, and those that are light should be marked until the whole has been tried, and then with the lighted smoker those marked could be carefully opened and examined. If any sealed combs are available these could be placed as close to the brood as possible, removing an empty frame from the brood nest to make room for the honey, but be careful in this case to break the cappings of the sealed stores before placing it where it is to go.

Another and a very important point should ever be observed with regard to newly hived swarms. While in ordinary seasons, when the weather is good and plenty of honey available, they will not give any cause for anxiety, but should the weather suddenly change, and a cold snap follow and continue for some time, it is more than likely the first half hour's sunshine will cause them to swarm out, and if not noticed they will make tracks and be lost. In such a case, if they are seen and food given, they will soon be content, and when they have food enough in store will give no further trouble. These may truly be called hunger swarms.

Occasionally bees will forsake their hives on any day during the summer season, either as a small swarm, or in some cases every bee, leaving not any sign or trace, except when the hive is examined, every drop of honey is removed, which very clearly shows the cause to be none other than starvation, and they leave their hive with the hope of bettering their condition elsewhere; obviously the remedy is to provide them with food.

Again, sometimes a colony will simply exist for a few weeks, making but little headway in breeding; while they may survive and eventually build up, they would not be of much value as honey gatherers for the coming season. Don't let your bees starve; rather see to it that they are making headway, even though feeding may be costly and require considerable attention; never mind, in every case cited it will more than pay for cost and trouble.

AGE AT WHICH BEES FIRST CARRY POLLEN.

By Dr. C. C. Miller.

Referring to the alleged proof that bees five days old carried in pollen, Mr. Samuel Suddaby expresses doubt as to the completeness of the proof, and raises the question whether it is not possible that the pollen-carrying bees might not have come from elsewhere. The doubt is legitimate, and the question entirely fair. Moreover, there are general principles involved of which at least the younger readers may be ignorant, and of which it is sometimes very important they should be informed; so I am glad of the opportunity to give the matter a somewhat full discussion.

Mr. S. asks, "Was it impossible for bees to get into that hive?" I feel warranted in saying that, for the first five days, it was impossible for any bee to enter from the outside. It was closed bee-tight. The hive was placed over another hive containing a full colony, the upper hive having a solid bottom nailed to it (years ago my hives had bottoms nailed on), and in that bottom was a two-inch hole to allow the heat to pass up from below. To prevent passage of the bees, wire cloth was nailed over the hole above; and, to prevent any communication through the wire cloth, another piece of wire cloth was nailed over the hole on the under side.

Then Mr. S. suggests the possibility that, when the hive was opened at the end of the five days, the bees entering with pollen may have been bees from other colonies, citing this special instance: "Last year I got an Italian queen and put her in one of my hives; and before the summer was over I saw Italian bees in at least two hives other than the one in which I put the queen. They appeared to be working the same as the other bees in the hive."

It is quite true that sometimes—perhaps it should be said oftentimes—bees enter the wrong hive on returning from the field, and being well laden, they are kindly received and given their naturalisation papers. A homeward-bound bee, heavily laden, and wearied with its long flight, may be beaten to the ground in front of some hive other than its own. Without rising on its wings to take its bearings it crawls directly into the hive, and without further ado is adopted as one of the family.

Put twenty hives in a straight row, six feet apart—ten feet if you like—on a level prairie with never a tree or other landmark except the hives themselves, and you may expect no little mixing. Bees are not good enough at figures to tell for certain whether their hive is the ninth or tenth from the end of the row, and so a bee may go ten feet out of its way to enter the wrong hive.

Paradoxical as it may sound, the same bee that would make a mistake of ten feet can not be induced to make a mistake of six inches under the right circumstances. In early spring, before bees have flown, close the entrance of an eight-frame hive all but three or four inches at the right end. After the bees have been flying busily for two or three weeks close the right end, and allow three or four inches opening at the left end. The bees, upon returning from the field, will go straight to the closed right

the brood, which is found in every stage. A few days would do but little harm, but when a continuance of days and perhaps weeks of wet and stormy weather obtains, when the bees cannot fly and replenish their stores, that within the hive is consumed in such large quantities that it soon gives out, at any rate that within reach of the cluster. At the same time there may be plenty of sealed honey in the hive but out of the reach of the clustering bees, hence not really available in such weather. The adult bees would survive for days, as they often do; but not so the larvæ, they must have food all the time, cold or no cold; without it disease and death naturally follows. A change of weather may find the workers too far reduced and too weak to fly, or even to reach and uncap the sealed stores within the hive, with the result that spring dwindling or some other disaster overtakes an otherwise fairly strong colony.

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end, taking quite a while to find the opening at the left end, and it will be days before they stop going first to the right end.

You see the bees go by looks, without carefully measuring distances. The bee may go to a wrong hive ten feet away because it looks just like its own; but it will not enter an opening only six inches distant at the other end of the hive entrance, because the left end doesn't look like the right end.

Well, of what practical value is all this? For one thing, the man who fully understands that it is not uncommon for bees to enter wrong hives will not hastily condemn as impure an Italian queen because he finds in her hive a few black or hybrid bees that have come from other hives.

For another thing, a proper understanding of the matters that have been mentioned will allow us to increase the number of colonies on the same ground without increasing the danger of bees entering wrong hives. Take that row of twenty hives previously mentioned, and somewhere near the middle of the row set a tree or a fence-post in front of the hives, or even behind them. A hive at the right of the post will not look like a hive at the left; neither will the second hive at one side of the post look like the first or third. In my time I have used a good many double hives—a bee-tight partition in the centre, with both entrances in front. Although the entrances were not six inches apart, I never had occasion to believe that a young queen on her return from her wedding-excursion ever entered the wrong side.

Again, a proper understanding will allow us so to place our hives as to double the number on the same surface of ground. Take again that row of 20 hives at equal distances. By the side of each hive in the row, and close up to it, you can set down another hive, doubling the number of hives in the row, and there will be no more danger of the bees mixing than there was before. A bee belonging to No. 14 is more likely to get into No. 12 or No. 16 than to get into No. 13, which is nearest to it.

Let us now turn to the question at issue. The queen was fastened in the hive, with no bees except those in the cells. No bee could enter from outside till the hive was opened at the expiration of the five days. A worker-bee from elsewhere, beaten to the ground by the wind, would not crawl into this hive just opened, but would crawl into the hive under it, standing on the ground. A worker from the hive below, on returning from the field, would not make the mistake of entering a place looking so unlike its regular entrance. Still less would a bee from any other hive make such a mistake, unless there was standing near by an entrance to a second storey, and nothing of the kind was there. Even supposing it possible that a bee might mistake this upper entrance for its own lower entrance, would it be likely that, within an hour, there would be a number of bees from elsewhere carrying pollen into a place where not a bee had before been flying? Moreover, the appearance of the bees was not that of old bees, but of bees only a few days old.

PURE-BRED SHEEP.

More Profitable than Scrubs.

Farmers and settlers are continually being urged to buy good pure-bred stock, as being the most profitable. The following interesting article, from one of the American experimental stations, bear this out most conclusively:—

"The low price of wool for many years and the competition of the vast free ranges of the Western States caused many farmers in the Eastern and Middle States to sell off their entire flocks and engage in dairying and other lines of farm work. Many of these farmers now realise that it would have been better policy to have retained a few of their best animals and build up a flock of heavy shearers and prolific breeders, and met the competition of the free range by better breeding and better methods. Many of these farmers, seeing their mistake, are now casting about for good sheep to use as breeding stock. There being two sources of profit from sheep—lambs and wool—it affords a wider margin between animals in regard to profit. A ewe shearing three pounds of wool may be able to rear a lamb that will sell in market for as much money as the lamb of a ewe shearing three times that amount. Yet the first may not return the cost of food consumed and the second return a handsome profit to the owner.

"A flock of common ewes will shear an average of from four to five pounds of wool. A flock of high-bred Delaines will average eight to ten pounds, a difference of four to five pounds, or 2s. 6d. to 4s. 6d. per head in the value of wool alone, and even this difference with a flock of 500 sheep means considerable. Reports show that the average weight of fleece in Baraga country was 2·92 pounds; for Oscodo country it was 8·12 pounds, a difference of 5·2 pounds. The explanation is, better breeding combined possibly with better feeding.

"The cost of starting in pure-bred sheep is not very great. By the end of the first year the flock should almost double the number, or say increase to 15 females; by the end of the second year to 22 females, by the end of the third year to 33 females, fourth year to 50 females, and fifth year to 75 females. The buck lambs in the meantime will, if castrated and sold for mutton, return a small profit above feed, and there is always a demand for good buck lambs among neighbours at a price better than mutton prices.

"Granting that the sale of buck lambs for breeding purposes only offsets the necessary purchase of a buck not related to the flock, we have the increased yield of wool over a flock of scrub sheep, which will be amply sufficient to pay the interest on the entire investment, and at the end of five years the 75 head of ewes and ewe lambs will stand the owner in an increased cost over common ewes of £24, allowing that 11 common sheep to start with would cost £6. In other words, a pure-bred flock of 75 ewes would represent an investment of £24 more than a flock of scrubs at the end of five years or 7s. per head. And if the owner should then desire to close out his flock

the pure-breds would outsell the scrubs or grades £1 to £2 per head. Aside from this, the wether or buck lambs will bring in an increased revenue over scrub stock. In Bulletin 178, Professor Mumford summarises the sheep industry as follows:—'First, the outlook for fine wools is bright, due to the almost universal falling off in numbers of merinos kept not only in the Michigan and the United States, but in nearly every wool-growing country. Second, it is doubtful if the American wool grower can ever afford to ignore the ultimate value of the carcass producing the fleece. Third, mutton growing with wool as an incidental product will continue to be a profitable industry. Fourth, every pound of wool consumed in the United States can be profitably grown here. Fifth, breed and feed affect the wool from the manufacturer's standpoint. Indiscriminate crossing is unprofitable. A sheep poorly nourished cannot produce a good fleece.'

"With Angora goats the advantages are equal, or possibly greater, than with sheep. They have the advantages of being better able to defend themselves against dogs and are cheaper kept. A goat will pass good grass or hay any time for bushes, briars, or weeds. Any farm infested with briars or brush will be greatly improved by the addition of a few Angoras to its live stock population. The receipts from goats under such circumstances are all profit, as they will improve the farm enough to compensate for all the extra feed and labour required. Registered goats cost about the same as registered sheep, and can economically be kept on the same farm as sheep, as their choice of roughage is material that sheep will not eat unless starved to it. Angoras are as easily handled in every way as sheep, except that it requires a better fence to hold them."

THE COMPOSITION OF FOODS FOR POULTRY.

By Frank H. Robertson.

Herewith is given a list of articles of food for poultry (taken from the New Book of Poultry by Lewis Wright) showing the analysis of same, which will be useful for those persons who wish to know the various properties of the foods they give their fowls, also as a table for the working out of a balanced ration, which is calculated in the following manner:— The carbohydrates, column No. 4, are added to the fats and carbohydrates as per column No. 3, and the result divided by the albuminoids, the result being the technical definition of the value of the food, viz.:—so many parts of albuminoids to so many parts of carbohydrates. The absolutely correct ratio for feeding fowls for a profuse egg supply would depend on circumstances, and the results of experiments, but scientists tell us that a narrower

ratio than one part of albuminoids to five of carbohydrates is necessary if a good yield of eggs is required; the wider a ration the greater proportion of carbohydrates, and *vice versâ* :—

Composition of Foods.

Articles of Food.	No. 1. Albuminoids or Flesh Formers.	No. 2. Fats or Oils.	No. 3. Fats × 2¼ = value in carbo-hydrates.	No. 4. Carbo-hydrates.	No. 5. Salts and Minerals.	No. 6. Husk or Fibre.	No. 7. Water.
Grains and Meals—							
Linseed meal	32·9	7·9 =	17·8	35·4	5·7	8·9	9·2
Beans and peas	24·0	1·5 =	3·4	48·0	2·5	10·0	14·0
Malt sprouts	23·2	1·7 =	3·8	48·5	5·7	10·7	10·2
Oatmeal	18·0	6·0 =	13·5	63·5	2·0	1·5	9·0
Middlings or fine sharps ...	16·0	4·0 =	9·0	57·0	4·5	4·5	14·0
Sunflower seed	16·0	21·5 =	48·4	21·4	2·6	29·0	9·5
Bran	15·5	4·0 =	9·0	44·0	6·0	16·5	14·0
Oats and ground oats ...	15·0	5·5 =	12·4	48·0	2·5	19·0	10·0
Wheat	12·0	1·8 =	4·0	70·1	1·8	2·3	12·0
Barley (and meal)	12·0	1·4 =	3·2	56·0	3·6	14·0	13·0
Millet seed	11·3	4·0 =	9·0	60·0	3·0	9·4	12·3
Maize	10·5	8·0 =	18·0	66·5	1·5	2·5	11·0
Rye	10·5	1·8 =	4·0	72·5	1·9	1·7	11·6
Buckwheat	10·0	2·2 =	5·0	62·2	2·0	11·0	12·6
Hemp seed	10·0	21·0 =	47·2	45·0	2·0	14·0	8·0
Dari	9·5	4·5 =	10·1	68·7	1·5	3·3	12·5
White bread	8·8	1·8 =	4·0	56·4	0·5	0·0	32·5
Rice	6·6	0·4 =	0·9	80·0	0·0	0·0	13·0
Brewers' grains	5·4	1·6 =	3·6	12·5	1·0	3·8	75·7
Vegetables—							
Potatoes	6·5	0·0 =	0·0	41·0	2·0	0·0	50·5
Red clover	5·0	0·8 =	1·8	13·3	2·4	6·5	72·0
Meadow grass	3·5	1·0 =	2·2	13·5	2·0	4·7	75·3
Hay	8·4	2·6 =	5·8	41·0	6·2	27·2	14·6
Cabbage	2·4	0·4 =	0·9	3·8	1·4	1·5	90·5
Onions	1·5	0·2 =	0·5	4·8	0·5	2·0	91·0
Turnips	0·5	0·1 =	0·2	4·0	1·0	1·4	93·0
Animal Foods—							
Dry meat meal	71·2	13·7 =	30·8	0·3	4·1	0·0	10·7
Flesh of fowls	21·0	3·8 =	8·5	0·0	1·2	0·0	74·0
Horse flesh	21·7	2·6 =	5·8	0·0	1·4	0·0	74·3
Lean of beef	20·5	3·5 =	7·9	0·0	1·6	0·0	74·4
Fresh-cut bone	20·2	26·1 =	58·7	0·0	24·0	0·0	29·7
Dried fish	48·4	11·6 =	26·1	0·0	29·2	0·0	10·8
Milk	4·0	3·5 =	7·9	4·8	0·7	0·0	87·0
Skim milk (separator) ...	3·1	0·3 =	0·7	5·3	0·7	0·0	90·6
Eggs (yolk only)	16·0	30·0 =	67·5	0·0	1·0	0·0	53·0
Do. (white only)	12·0	2·0 =	4·5	0·0	1·2	0·0	84·8
Blood meal (W.A. analysis)	81·52	1·98 =	4·4	0·0	6·55	0·0	9·95

Herewith is also given a table showing the ratio of Ration No. 4, on page 5 of Bulletin No. 16, issued by this department, on feeding of poultry,

which works out at 1 : 5·20. If it were desired to make the feed of a more nitrogenous description, less maize could be used or more cut bone:—

Articles of Food.	Albuminoids.	Fats or Oils.	Fats × 2·25.	Carbo-hydrates.
2ozs. Cut Raw Bone ...	20·2 × 2 = 40·4	26·1 × 2 = 5·22		
3ozs. Bran	15·5 × 3 = 46·5	4·0 × 3 = 12·0	...	44·0 × 3 = 132·0
3ozs. Chopped Cabbage ...	2·4 × 3 = 7·2	0·4 × 3 = 1·2	...	3·8 × 3 = 11·4
2ozs. Pollard	16·0 × 2 = 32·0	4·0 × 2 = 8·0	...	57·0 × 2 = 114·0
12ozs. Oats	15·0 × 12 = 180·0	5·5 × 12 = 66·0	...	48·0 × 12 = 576·0
15ozs. Maize	10·5 × 15 = 157·5	8·0 × 15 = 120·0	...	66·5 × 15 = 997·5
	463·6	259·4 × 2·25 = 583·65		1,830·9

Ratio 1 : 5·20.

Recent experiments by the M. S. Department of Agriculture on the digestion of various poultry foods, shed however light on another aspect of the question, viz., the digestibility of grains, showing that although a ration may be strong in albuminoids and balanced to a narrow ratio, yet another ration may be produced on a much wider scale and yet yield better egg production than the narrower and more expensive diet. The question of palatability and assimilation must receive due consideration, and it was conclusively shown by these experiments that the digestibility of maize far exceeds that of wheat and oats, the latter especially so, therefore the value of maize as a poultry feed is greater than is generally supposed, and its use in actual practice has been proved by the good results at the recent New South Wales Egg Laying Competitions. Mr. Thompson in his report at Hawkesbury says: "This year the grain ration was composed of three parts wheat to one part maize, compared with three parts maize to one part wheat last year; and while we have no wish to put the shortage of eggs compared with last year down to wheat feeding, we have no hesitation in saying that if we had fed more largely on maize we would have had at least equal results or even better."

In conversation with an experienced poultry-keeper he also informs me that he is largely feeding maize to black Orpington's and getting a very good egg supply. Thus scientific experiments bear out practice in this particular. Another breeder, using malt sprouts to make his food stronger in albuminoids, found that the assimilation was not good, undigested fibres being clearly noticeable in the excreta.

This aspect of the feeding question will be more fully dealt with in future articles.

THE WHITE WYANDOTTE.

The general characteristics of the White Wyandotte are the same as in gold or silvers, in fact, in all varieties, but the counting of the points is different. In whites the heaviest scoring is 20 for size and condition against 14 in silvers, but the employment of but one numerical valuation for two qualifications is not definite enough. I prefer to divide it, and allow 10 for size and 10 for condition, comb 8, head 6, ear-lobes and wattles 8, neck 10, back 10, body 12, wings 10, tail 8, legs 8. The standard description of the colour of White Wyandottes is, in both sexes:—Beak, bright yellow; eye, bright bay; comb, face, ear-lobes, and wattles, bright red; plumage, pure white throughout, straw colour to be avoided; legs and feet, bright yellow.

Now to arrive at a clear and distinct understanding as to exactly what the standard requires. The heaviest scoring is 12 points for body, which means that the bird's body is the principal thing, both as regards shape and colour. But first considering shape, the standard reads:—Breast, full and round; keel bone, straight. The remainder of the description is exactly the same as in gold or silver varieties, viz., a compact blocky bird, full breast, broad and short back, the legs and shanks of medium length, not short as in the Orphington, yet in no wise approaching the Langshan in that respect. Then as regards plumage, the standard says nothing about it being close or tight, but on the other hand the tendency is all the other way, The saddle is described as full and broad, rising with concave sweep to tail. Thighs well covered with soft, webless feathers. Fluff, full and abundant. From these particulars it will be seen that the plumage required is not hard and tight but rather soft and full, though avoiding anything approaching the superabundance of the Brahma or Cochin on the one hand, and on the other the tightness of the Langshan or Indian Game. Last, but perhaps most important of all, is colour. It is quite useless nowadays to show any but pure white birds at our leading shows; any inclination to show a straw tinge in the feathers tells heavily against a bird, and the ones of the purest white win, provided they are good in other respects. To attain this snow-white feather requires a good deal of skill and patience in the preparation of birds for exhibition, chiefly by keeping them in well-shaded pens and careful washing. But occasionally are to be found birds possessed of what is known as "stay-white" plumage, which does not turn brassey or yellow from exposure to the sun or winds. Such are, however, rather rare, and are of course much to be preferred. At the same time the art of bleaching a bird by means of chemicals is not uncommon, but as it virtually amounts to dyeing, is not to be commended, and is "faking" just as much as changing white feathers to black, with the difference, however, of not being so liable to be found out. Black feathers are also very common, and many fine specimens are flecked with black spots in various parts of the plumage.—*Morning Herald.*

NITROGEN AND NITROGENOUS FERTILISERS.

By PERCY G. WICKEN.

Nitrogen, known to chemists as "N," and of an atomic weight of 14, is one of the most important elements in nature, and in its compounds forms substances of a most contradictory character. It is a colourless, tasteless, odourless gas, and forms about four-fifths of the bulk of the atmosphere; the total weight of all the nitrogen in the air is calculated as somewhere about 8,800,000,000,000,000 tons, a supply that may be taken as inexhaustible.

Every living thing in nature, both plant and animal, needs nitrogen for its life, but although bathed in nitrogen, neither plants or animals can utilise it for building up their tissue except when combined with some other element. Lightning causes a small quantity of the atmospheric nitrogen to combine with oxygen, which is carried down by rain for the use of plants. The supply from this source, however, is very small, and plants draw most of their supplies of this element from the decayed remains of former generations of plants and animals which decompose in the soil; this supply would, however, soon become exhausted. Therefore nature has come to the rescue with a wonderful provision in the form of the leguminose tribe of plants, these include, peas, beans, lucerne, clover, and other pulse crops. This tribe of plants are attacked by a disease, parasite, or microbe, which takes up its abode on the roots of the plant and causes small nodules or swellings in which it lives. This microbe actually sucks in the free nitrogen from the air and transforms it into compounds which the host plant can use for food, and by this means enormous quantities of atmospheric nitrogen are converted into a form in which living things can utilise it. This is the reason that after a leguminous crop has been grown the following crop is so much improved owing to the nitrogen supplied to the soil from the decaying roots and leaves of the preceding crop. The introduction of this parasite or bacteria to such districts as it is not already flourishing in, has been one of the latest developments of scientific agriculture, and the cultures can now be put up in such a form that they can be sent to any part of the world and then liberated on their host plant.

Other prominent features of nitrogen are:—It forms poisonous compounds as prussic acid, strychnine, and morphine, which shows that it can take away as well as give life. It also forms a number of very valuable dyes, as well as giving us quinine and other valuable medicines. In another form and in other combinations it supplies us with our most powerful explosives, such as nitro-glycerine and gun-cotton, and others not so well known.

It is, however, in its combinations as a fertiliser that we are chiefly concerned in the present article:—

(1.) It occurs in the form of nitrates combined with hydrogen and oxygen, and forming nitric acid, which, combining with metals, forms salts.

(2.) It occurs in combination with hydrogen in the form of ammonia, which is a colourless gas with a familiar odour, and is present in the air in small quantities, and is formed by the decomposition of organic bodies containing nitrogen.

(3.) It occurs in several forms of animal and vegetable matter in combination with hydrogen, oxygen, and other elements, in the fibrine of blood, casein of milk, albumen of egg, etc.

The following are the principal forms of fertiliser by means of which nitrogen is supplied to the soil, and they may be divided into three classes:—

(1.) Nitrogen in the form of nitrates, such as—

Nitrate of soda	Nitrate of potash.

(2.) Nitrogen in the form of ammonia, as—

Sulphate of ammonia.

(3.) Organic nitrogen, as—

Blood manure	Guano
Bone-dust	Oil-cake
Digester refuse	Dried offal and fish
Urine	Hair and wool
Dried flesh	Farmyard manure, etc.
Dried nightsoil.	

Of these the first group is the most valuable, the nitrogen contained in the form of nitrates is worth about 17s. per unit.

In group 2, sulphate of ammonia is worth a little less than group 1, but is generally calculated at the same rate.

In group 3 the nitrogen is not in such a soluble form and is worth less, or about 14s. 3d. per unit, and in the case of hair and wool, which is very insoluble, somewhat less.

Nitrogen is the most important, most expensive and most effective element of plant food, and the ingredients mentioned in group 1 are the highest grade of this class. A nitrate is the result of a union between nitric acid and an element called a "base." Nitric acid contains the nitrogen that is necessary for the growth of plants. It unites with many different elements, and forms salts that are useful for many purposes. When united with potash it forms nitrate of potash, and when with soda nitrate of soda.

Nitrate of Soda is found in large quantities in the north of Chili, in South America. The beds of nitrate, or, as it is sometimes called, "caliche," before it is refined, are several thousand feet above the sea on a desert plain extending for 75 miles north and south and about 20 miles wide in a rainless region. The surface is covered with earth or rock, and under this is found the nitrate of soda. In its crude state the material contains about 50 per cent. of nitrate of soda; it is refined by boiling in water to dissolve the nitrate and allowed to cool, when the nitrate settles in the form of the familiar crystals. About a million tons annually are exported, and the material, as exported, contains about 15 per cent. of nitrogen. It is used in many mixtures as the form of nitrogen supplied, and is valuable by itself as a top-dressing for plants while growing and to stimulate any plants that are backward in growth.

It can be purchased in Perth for £14 per ton, while its value on a basis of 17s. per unit value is £12 15s.

Nitrate of Potash, or as it is more commonly known, saltpetre, contains about 13 per cent. of nitrogen and 46 per cent. of potash (Victorian analysis). It is found in a raw state in the Bengal province in India, and smaller deposits in other parts of the world. In Bengal it is collected by a special caste, the

"Sorawallahs," partly from the soil and partly from the surface of mud heaps, mud cottages, etc., by scraping off the uppermost layers which show a white efflorescence; the mud of the Ganges also contains nitrate of potash. It is refined in a very crude manner before being exported. Nitrate of potash is also made chemically from nitrate of soda by a process known to the trade.

The general reason given as to why nitrate of potash is not more extensively used as a fertiliser is that the cost is too high, but this does not appear to be borne out by facts. Taking the analysis as above 13 per cent. nitrogen and 46 per cent. potash, and applying the unit value of 17s. for nitrogen and 6s. for potash, we find the value at current rates is £24 17s. per ton. No quote is obtainable in Perth, but it is quoted in Melbourne at £20 per ton, and should be obtainable here at a slightly advanced rate, and if so, it is the cheapest form in which both nitrogen and potash can be obtained. It should also be taken into consideration that one ton of nitrate of potash will contain almost as much fertilising material as one ton of nitrate of soda, plus one ton of sulphate of potash, and that therefore the cost for freight and handling charges on one ton of useless ingredients are saved to the farmer; and when we consider that this means shipping freight, wharfage, handling charges at the port, railway freights and cartage to the farm, it will be seen that the saving is considerable. Mixed with a quantity of bone-dust to supply the phosphoric acid, nitrate of potash will form a complete fertiliser of a high grade.

Owing to the nitrogen being in the form of nitrates it is immediately available for plant food, and is therefore better applied as a top dressing when the plants have made a good growth, or, if sown with the seed, should only be put lightly on the surface.

Sulphate of Ammonia contains the nitrogen in the form of ammonia, and, when pure, contains about 25 per cent. of ammonia or about 20 per cent. of nitrogen. It is the principal rival of nitrate of soda in the fertiliser trade; it is just as soluble but not quite so quick-acting as nitrate of soda, as the ammonia has to be converted into nitrates in the soil before it is available as plant food; this does not take long, and under some circumstances is an advantage. Sulphate of ammonia is a by-product in the manufacture of coal gas, and is made both in Melbourne and Sydney, but not in Perth. As sold in the trade, it is a whitish salt, although sometimes of a greyish or blue-grey colour, or even brownish. If allowed to remain in the bags it soon rots them through and is better only obtained as required; it is also liable to cake up if stored, and to require crushing before it can be used. At the present value of fertilisers, sulphate of ammonia is the cheapest form in which we can obtain our nitrogen. It contains 20 per cent. of nitrogen, which, taken at the unit value of 17s. per unit, makes the value of the fertiliser £17 per ton, and this is the price asked for it in Perth. Compared with sulphate of ammonia at 17s. per unit, the cost of nitrogen in nitrate of soda is 18s. 6d. per unit; or, to put it in another form, by buying a ton of nitrate of soda for £14 we obtain 336lbs. of nitrogen, the cost of the nitrogen being 10d. per lb.; by buying a ton of sulphate of ammonia at £17 we obtain 448lbs. of nitrogen, the cost of nitrogen being 9d. per lb., or a difference of 1d. per lb. in the cost of nitrogen in the favour of sulphate of ammonia. In the Eastern States, where sulphate of ammonia is frequently sold for less than nitrate of soda, the difference is much more in favour of sulphate of ammonia.

Soot may be classed as another form of inorganic nitrogen, although the supply is so small and the percentage of nitrogen so low that it is hardly worth paying carriage on. It contains from two to three per cent., but even

this is a varying quantity. Where, however, a supply is available at a cheap rate it is worth using as a source of nitrogen.

Blood Manure.—Of the organic forms of nitrogen blood manure takes the highest place, containing from 11 to 12 per cent. of nitrogen. It is prepared from the blood at the large slaughter yards adjacent to cities or boiling-down works. The blood is run into pits and then treated and dried, being again ground into a powder before being sent out as a fertiliser. Nitrogen in the form of blood is not so valuable as in the form of nitrates, and under the same scale is worth 14s. 3d. per unit, consequently blood manure as a fertiliser is worth about £8 per ton, according to the percentage of nitrogen contained. The quantity of blood manure manufactured is not large and very little is available in the Perth market.

Bone-dust is another form of organic nitrogen; it contains three to four per cent. of nitrogen and about 20 per cent. of phosphoric acid, consequently it is more of a phosphatic manure than a nitrogenous one, and will be dealt with more fully under that head.

The finer the bones are crushed the quicker the nitrogen becomes available as plant food. Green bones contain a higher percentage of nitrogen than steamed bones, but this is counteracted, to a certain extent, by the fact of the fat in the bones causing them to take a longer time to decompose and the nitrogen not being so readily available as plant food. The nitrogen in bone-dust is worth 14s. 3d. per unit.

Boiling-down refuse.—It is very hard to make a distinction between this and bone-dust, large quantities being sold as bone-dust or bone manure. It consists of the refuse of the boiling-down vats after the tallow has been taken off, and consists of the bones, condemned meat, etc., left in the vat. This is dried, ground up and used as a fertiliser. When sheep are plentiful in the Eastern States, many large works do nothing but boil down old sheep for the tallow, and the meat, etc., is made into a fertiliser. Boiling-down refuse generally contains a higher percentage of nitrogen, and a lower percentage of phosphoric acid than pure bone-dust, and is equally as good as a fertiliser. The nitrogen is worth the same as in bone-dust, viz., 14s. 3d. per unit.

Guanos are more or less a source of nitrogen, and generally contain a small percentage, varying from 2 to 4. Guano is the accumulated dung from sea-birds, generally found on islands or the coast. When obtained fresh it contains a small quantity of nitrogen, but as it becomes older and more washed by the rain the nitrogen gradually disappears; they, however, contain a quantity of phosphoric acid. The unit value of the nitrogen is 14s. 3d. per unit, the same as in bones.

Urine contains a small percentage of nitrogen, as also does *Nightsoil* when dried and prepared as a fertiliser, the amount being only from ·03 to ·75 per cent., and it also contains about the same amount of phosphoric acid and potash, and is consequently a very low value fertiliser.

Oil-cake, as made by Messrs. Lever Bros. in Sydney, contains 3·45 per cent. of nitrogen, as well as a small percentage of phosphoric acid and potash and provided it can be purchased at a price corresponding with its unit value, is of value as a fertiliser. The unit value on our basis is about £3 15s., which is much below the price at which it can be purchased.

Wool-waste from the wool scouring works contains about 8 per cent. of nitrogen, while the sediment from the tanks contains ·59 per cent. of nitrogen, both of which, where obtainable cheaply, are of value as a fertiliser.

Decomposed hair and lime from the fellmongery works contains about 7 per cent. of nitrogen, while the refuse from the tannery contains 2·24 per cent. of nitrogen.

Among other items available as fertilisers farm-yard manure contains ·40 per cent. of nitrogen; fowl manure 1·47 per cent. of nitrogen; decomposed fish 6·10 per cent. of nitrogen; sheep manure, 1·79 per cent. of nitrogen; and sea-weed, in a fresh state, ·16 per cent. of nitrogen. Most of these latter ingredients are not readily obtainable on the market, but to those situated adjacent to works at which the above are by-products, or near the coast, where the supply can be obtained at a low figure and the cost of cartage is not excessive, are all worth consideration as a source of nitrogen; provided that they can be placed on the ground at a cost not exceeding their value on a unit basis compared with other more concentrated fertilisers, and also taking into consideration the extra bulk of material that has to be handled to obtain a similar quantity of the fertilising ingredients.

FEEDING DAIRY CATTLE.

The question of feeding stock is one that requires a considerable amount of attention, and a brief summary of some of the experiments carried out in the United States of America may prove a guide to those engaged in this industry. The value of a ration for animals depends on the nutritive value, and this is found by multiplying the proportion of the protein into the carbohydrates and fat. The nearer the two approach each other the richer the food. Too concentrated a food is not good and a certain percentage of roughage has to be added to make up the necessary quantity of fodder an animal has to consume. A fair average ratio for dairy cows is about 1 to 4·5, and a ration should be compounded which will give about this ratio.

Protein builds up the muscle and is necessary for the production of growth in the animal body and for milk.

Carbohydrates produce heat and fat in the body or in the milk.

Fat, which serves the same general purpose as the carbohydrates, is found to be worth $2\frac{1}{4}$ as much in food value as an equal amount of carbohydrates. In calculating rations it is multiplied by $2\frac{1}{4}$ and added to the carbohydrates.

At the Vermont Experimental Station, according to Henry's "Feeds and Feeding," a series of trials were conducted with feeding two groups of

animals, one on maize feed and the other on corn meal and bran in conjunction with the necessary amount of roughage.

One group consumed 2,424lbs. of roughage and 1,000lbs. of maize feed and produced 2,388lbs. of milk and 114·3lbs. of fat, the other group consumed 2,427lbs. of roughage and 1,008lbs. of corn meal and bran, and yielded 2,164lbs. milk and 102·2lbs. fat, or a difference in favour of the maize feed of 224lbs. of milk and 12·1lbs. fat. The roughage consisted of two parts hay and one of silage. Taking the cost of this feed at Perth prices the cost per lb. of milk works out about the same, viz., ·73d. per lb. for the maize feed, or 7¼d. per gallon, and ·70d. per lb., or 7d. per gallon for the maize and bran feed. The conclusion to be drawn is that there is a little benefit to be derived by feeding on maize in lieu of maize and bran mixed; the yield is slightly increased but so is the cost. At the Maine Experimental Station a similar experiment was carried out, testing wheat meal *versus* corn meal, with the following results:—

—	Average daily yield.		Weight.		Water drank daily.
—	Milk.	Fat.	Gain.	Loss.	—
	lbs.	lbs.	lbs.	lbs.	lbs.
Wheat Meal	19·7	·87	8	...	61
Corn Meal	18·8	·85	...	76	64
Wheat Meal	17·0	·84	6	...	68

Six cows were fed and given a stated time on each feed, the ration supplied was Timothy hay 18lbs., wheat meal 5lbs., cotton seed meal 2lbs.; in the second period corn meal was substituted for wheat meal. Making allowance for the decreased milk flow as the lactation period lengthened, the results may be regarded as practically equal, from which they conclude that wheat meal is equal to corn meal as a feed for the dairy cow.

Substituting oaten for Timothy hay and cocoa-nut cake for cotton seed cake, the cost of a similar ration at Perth rates would be 1s. 1d. per day, but it is presumed the cows were run in a paddock, as no mention is made of the roughage fed them to make up the quantity of food required.

At Ontario Agricultural College in Canada, and at the Copenhagen Station in Denmark, experiments were carried out as to feeding mixed grain and wheat grain to cows. Both stations arrived at the same results. The Copenhagen test was much the larger, 447 cows being employed for the purpose. The first lot of cows received a mixture of barley and oats, the second lot one-half wheat bran and one-half grain mixture, while the third lot received wheat bran only. The results are summarised as follow:—

—	Mixed Grain.	One-half Grain, one-half Bran.	Wheat Bran only.
Average milk yield per cow, lbs.	21·9	22·1	22·1
Average per cent. solids in milk	11·66	11·75	11·77
Average per cent. fat in milk ...	3·04	3·11	3·12

The results agree closely, and from them we may assume that wheat bran is of equal feeding value for milch cows with a mixture of barley and oats.

At the Wisconsin Station a similar trial was carried out, testing ground oats *versus* bran as a food for dairy cattle. Ten pounds of these foods were given each in addition to the ordinary food.

—	Daily Milk Yield.	Daily Fat Yield.	Per cent. Fat.
	lbs.		
Ground oats	21·07	·933	4·65
Bran	19·19	·845	4·68
In favour of oats	1·88	·088	·03

This gives a return of 10 per cent. more milk and fat from oats than bran, and the high value of oats in the dairy is well illustrated in this trial.

A test of value to dairymen was carried out at the Wisconsin Agricultural College, at which it was ascertained that the feed necessary to produce 100lbs. of milk and 100lbs. of butter was—

	100lbs. Milk.	100lbs. Butter.
(1.)	193lbs. stover, 60lbs. corn meal and bran.	3·880lbs. of stover, 1·233lbs. of corn meal and bran.
	Or	
(2.)	71lbs. mixed hay, 62lbs. corn meal and bran.	1·348lbs. mixed hay, 1·200lbs. corn meal and bran.
	Or	
(3.)	60lbs. clover hay, 63lbs. corn meal and bran.	1·179lbs. clover hay, 1·231lbs. corn meal and bran.

The cost of this feed at Perth in the first instance (the corn meal and bran being fed in the proportion of five parts of corn meal to seven of bran) would be 6s., or 7·2d. per gallon of milk. To feed the corn-stover the dairyman would have to grow the corn.

In the second instance the cost is 6s. 3½d., or 7·5d. per gallon of milk.

In the third case the cost would be 5s. 8d., or 6·8d. per gallon of milk; but as in the former case the clover would have to be grown.

Another experiment carried out at Ontario is of value to dairymen. A number of cows were fed on:—

Ration I.—Silage 50lbs., hay 6lbs., bran 5lbs., and produced 29·7lbs. of milk per day. The cost of the feed works out at 14d., the milk cost for feed being 4·7d. per gallon.

Ration II.—Silage 30lbs., oat straw 20lbs., hay 10lbs.; the milk yield being 21·8lbs. of milk per day. The cost per gallon for feed works out at 5·5d.

Ration III.—Hay 20lbs., oil meal 4lbs., cotton seed meal 5lbs.; the milk yield being 29·3lbs. per day. This ration costs 13d., and the cost per gallon of milk works out at 4·4d.

Ration IV.—Hay 20lbs., pea meal 4lbs., oatmeal 5lbs., corn meal 8lbs.; the milk yield being 31·8lbs. per day, the cost of the ration being 24d., and the cost per gallon of milk 7·5d.

Ration I. is the general ration fed to all the cows.

Ration II. consists of all coarse feed, supplying more carbo-hydrates and less protein than the cow required.

Ration III. contains an ample supply of carbo-hydrates and an over supply of protein.

Ration IV. contains an excess of nutrients.

Before we can provide a cheap and nutritious fodder for dairy cattle, dairy farmers will have to grow maize. The cow will eat maize in almost any form. Milk production calls for a large amount of protein in the ration, and the protein constituent is not abundant in corn; for this reason corn should not form more than one-half or three-fifths of the concentrates in the food. The best way to use corn is to run the stalks, cob and all, through the feed cutter or shredder.

Oats are a prime feed for the dairy cow. The husk of the oat, though carrying little nutriment, renders this grain a feed of light character in the stomach and easily digested.

Next to corn wheat bran is the best cow feed obtainable in this country. It is rich in protein carrying a fair amount of starchy matter, its light, chaffy character renders it valuable mixed with grain. Its value closely approximates to cotton-seed meal, for which it may be used as a substitute. Six to 8lbs. of bran per day may be fed to cows. Barley is largely used in Denmark, but should not be fed extensively alone, but goes well when fed in conjunction with root crops. From 3 to 5lbs. of barley is sufficient for a ration.

Silage is of the first importance to dairy farmers. Silage is relished by the cow, and she thrives on it and milks well. As corn silage is rich in carbo-hydrates and low in protein, clover hay is the common supplementary feed (lucerne will do). Ensilage should only be fed in conjunction with some other dry food.

The following are a list of rations suitable for dairy cattle and in actual use:—

20lbs. lucerne hay, 5lbs. oat straw, 2½lbs. wheat bran, 2½lbs. shorts, 1½lbs. cotton-seed meal.

10lbs. hay (grass), 10lbs. clover hay, 8lbs. maize, 1½lbs. oats.

30lbs. ensilage, 5lbs. clover hay, 3lbs. corn fodder, 1lb. oat straw, 5lbs. bran, 2lbs. oil meal, 2lbs. cotton-seed meal.

50lbs. corn ensilage, 5lbs. hay, 5lbs. corn fodder, 1lb. oat straw, 1lb. barley straw, 5lbs. maize, 2½lbs. ground oats and barley.

20lbs. grass hay, 10lbs. corn straw, 5·7lbs. corn meal, 2·9lbs. bran, 1·4lbs. oil meal.

24lbs. corn ensilage, 8lbs. corn meal, 2lbs. bran, 4lbs. oats, 2lbs. oil meal.

30lbs. corn silage, 8lbs. fodder corn, 3lbs. corn meal, 3lbs. bran, 1lb. cotton-seed meal.

35lbs. lucerne hay, 6⅔lbs. bran, 3⅓lbs. barley.

15lbs. lucerne hay, 7lbs. bran, 7lbs. shorts, and 2lbs. malt sprouts.

40lbs. corn silage, 8lbs. clover hay, 6lbs. bran, 2lbs. pea meal.

45lbs. turnips, 7lbs. wheat chaff, 15lbs. ensilage, 2½lbs. oats, 2½lbs. pea meal.

"RICKETS."

By R. E. Weir, M.R.C.V.S.

This may be considered one of the more common ailments of young stock as the result of rearing on country deficient in salts of lime. The complaint is more particularly noticeable amongst foals and lambs bred on our lighter lands. Portions of the Eastern District and some of the Northern parts of the State are undoubtedly wanting in inorganic elements, such as phosphates and carbonate of lime. The disease may be described as an unnatural flexibility of the osseous system—more particularly the long bones, which, on account of their unusual softness, bend under the weight of the body and gives an appearance of malformation to the animal affected. Not only does a lack of lime salts occur in the bones themselves, but a lack of power to assimilate is very noticeable from an inordinate excretion of those elements from the kidneys during the progress of the disease. As the affected animal matures, a supply of earthly salts may be secured to fill up the open porous parts, and eventually the bone becomes firm, but the curvature remains as a permanent condition throughout life. In the event of the disease continuing for any lengthened period, the small bones and articulations may become implicated. This will be made apparent by severe lameness, the little animal moving about very gently on its toes, and evidently afraid to place the foot to the ground. Should the vertebræ be diseased, symptoms of partial paralysis will be noticeable when the animal attempts to rise from a recumbent position. In all instances there is an irregularity of the bowels, and the milk passes through in an ill-digested, curdy condition, with a very sour odour. Mortality from this cause is not generally of a virulent character, but the natural growth of the affected animals is often seriously impeded.

To prevent the disease, therefore, it will be apparent that the preventive measures require to be directed towards removing breeding animals from lands deficient in earthy salts to other country known to have these elements in sufficient quantities. This should be done not less than about three months prior to and should not be returned until about the same time after the period of parturition. Should this be found impracticable, especially in the case of mares, they can be artificially fed during the period mentioned and the desired effect should thus be secured.

Curative measures desire to be directed towards remedying any digestive derangement, and for this purpose, aperients, such as castor oil, require to be administered. This is to be followed with small doses of calcium phosphate and sulphate of iron.

THE GOVERNMENT LABOUR BUREAU.

REPORT FOR AUGUST.

I have the honour to submit the following report on the work of the Government Labour Bureau for the month of August, 1905.

PERTH.

Registrations.—The total number of men who called during the month in search of work was 938. Of this number 554 were new registrations and 384 renewals, *i.e.*, men who called who had been registered during the year prior to the month of August. The trades or occupations of the 938 applicants were as follows:—Labourers, 386; handy lads, 78; handy men, 62; farm hands, 58; carpenters, 45; cooks, 29; bushmen, 28; gardeners, 22; miners, 15; horse drivers, 14; plumbers, 13; clerks, 12; painters, 12; fitters, 11; yardmen, 11; grooms, 9; engine-drivers, 8; hotel hands, 8; kitchenmen, 8; joiners, 7; blacksmiths, bricklayers, plasterers, bakers, carpenters (rough), 5 of each; butchers, firemen, shearers, storemen, 4 of each; boilermakers, caretakers, strikers, tailors, wheelwrights, 3 of each; and 46 miscellaneous.

Engagements.—The engagements for the month numbered 251. The classification of work found was as follows:—Labourers, 141; farm hands, 20; bushmen, 18; handy boys, 11; cooks, 9; handy men, 9; carpenters, 8; gardeners, 6; boys for farms, 4; horse drivers, 3; yardmen, 3; carpenters (rough), 2; grooms, 2; orchardists, 2; and 13 miscellaneous.

FREMANTLE.

Registrations.—There were 640 new registrations and 160 renewals. The applicants for work were chiefly unskilled labourers.

Engagements.—The was one engagement. The female servants who called numbered four, and engagements two.

KALGOORLIE.

Registrations.—The new registrations were 141 and renewals 46.

Engagements.—There were 19 engagements, classified as follows:—Engine-drivers, 3; miners, 3; fitters, 2; and 11 miscellaneous.

Female Servants.—The new registrations were 38 and renewals 23; total 61. The engagements were nine.

CUE.

There were no callers.

WOMEN'S BRANCH, PERTH.

Registrations.—There were, in connection with the women's branch, Perth, 106 new registrations and 121 renewals. The classification was as follows:—Housemaids, 44; and generals, 37; light generals, 32; laundress charwomen, 31; useful girls, 22; waitresses, 15; cooks, 15; housekeepers, 12; cook-laundresses, 4; lady-helps, 4; and 11 miscellaneous.

Engagements.—The engagements numbered 73, classified as follows:—Generals, 18; laundresses, 17; light generals, 12; useful girls, 9; cooks, 3; housemaids, lady-helps, housekeepers and charwomen, two of each; and six miscellaneous.

General Remarks.

The number of men who called at the central office, Perth, during the month was 938. This total is 180 in excess of the number for July, and 114 in excess of that for August last year. The engagements totalled 251, this being 55 in excess of the number for July, and 18 short of that for August last year. At the Fremantle branch there were 800 applicants for work, a number of whom are registered on the books of the central office, Perth, and travelled to Fremantle with the expectation of being engaged for work in connection with the railways. There was one engagement. Four females called and two were found engagements. At Kalgoorlie there were 187 applicants for work and 19 engagements. The females who called numbered 61, and engagements 9. At the women's branch, Perth, 227 women called, and the engagements were 73. The removal of the Labour Bureau to Irwin Street was effected during the month. The male and female branches are now under the same roof, although, as heretofore, distinctly separate entrances are provided for each branch. For the convenience of the public the women's branch will shortly be separately connected with the Telephone Exchange.

POISON PLANTS OF WESTERN AUSTRALIA.

One of the most serious drawbacks to stock raising in some parts of this State is the existence of poison plants. Illustrations of the most common ones, such as "York Road" and "Box-bush," have been frequently published in the *Journal* for the information of settlers.

Some time ago the Department of Agriculture commenced investigations in order to find out the nature of the poison that existed in those plants for the purpose of supplying an antidote if possible.

In the course of carrying out their investigations, a specimen of *gastrolobium*, commonly known as the "narrow leaf," was sent to the Imperial Institute, London, requesting at the same time that any information they could give on the subject might be sent to the Department.

The director has just received a reply, stating that the investigations carried out by the physiological branch of the Institute had failed to find the poison in the plant known as the narrow-leaf, which was sent to the Institute for the purposes of experiment.

It rested, however, to our own Government Analyst, Mr. E. A. Mann, to find out the poison in the "York Road" poison plant.

Mr. Mann has been untiring in his efforts in experimenting with the poisonous plants, and his achievement in this instance is all the more gratifying, especially when it is remembered that some of the best outside scientific skill had been so far requisitioned without the desired result.

At the instance of Mr. Mann, the Director of Agriculture asked the Government to specially engage Dr. W. H. Ince, a gentleman with considerable knowledge in plant physiology, for the purpose of making a thorough investigation of these troublesome plants. The experiments were conducted at the laboratory of the Government Analyist, the York Road plant being taken as being the most typical. After several unsuccessful attempts to isolate the poison, a crystalline substance of an alkaloidal nature had been extracted. A physiological experiment was made with a guinea-pig. The death of the animal, which took place in five minutes after an injection of 1-10th of a grain of the substance, showed that a powerful poison had been obtained.

Much work yet remains to be done before the poison can be obtained in sufficient quantity and purity to thoroughly study its effects and character. Dr. Blackburne, the Government Bacteriologist, who conducted the physiological experiment, states that, so far as was observed, the poison caused death by convulsions and probably paralysis of the respiratory system. The work will be pushed further with vigour during the next few weeks. When the investigations of the York-road poison shrub are completed, there will still remain a number of other plants to be experimented with, but, as the Government Botanist reports that they are all of the same natural family, it is possible that a similar poisonous principle may be in all. The Government Analyst expresses his appreciation of the able manner in which Dr. Ince has carried out the work entrusted to him.

The chief object of this series of investigations is, of course, to try and obtain an antidote or a method of rendering animals immune to the effects of these poisons, which have caused a loss, it is estimated, of between £15,000 and £20,000 to stock-owners per annum. A careful chemical examination of the poison is necessary before anything definite can be done in the direction of an antidote, etc. As a means of conducting experiments with living animals, an experimental station is being established at the Stock Quarantine Depôt at Subiaco.

As there is yet some doubt among qualified men as to whether there has been really a case of true swine fever in the State, an opportunity will shortly be afforded to prove or disprove it by means of a thorough investigation of the animals brought to the experimental depôt.

CONTAGIOUS ABORTION IN CATTLE.

By C. L. Barnes.

The term abortion is applied to the premature birth of the offspring before full term. It is sometimes known as "slinking," "casting," or "losing" the calf. Abortion may be caused by drinking considerable ice-water, eating a large quantity of cold food (frozen roots or green vegetables covered with frost), exposure to rain or snow-storms or wading in ice-cold water, injuries to the abdomen (as being crushed by a gate, kicks, or being hooked), foods that are easily fermented, also insufficient or very innutritious foods; too close stabling, heavy milking, early breeding, inbreeding, stagnant drinking water, ergoted grasses and smut in the various grains, irritant vegetables, impaction of the rumen and constipation, severe constitutional diseases, direct irritation of the womb (as in the removal of the ovaries or death of the offspring), and irritation of the kidneys. Whenever abortion of cows cannot be traced to any of the above causes the contagious form of abortion is to be suspected.

Contagious abortion is quite common in this State and frequently causes considerable loss, not only from losing the young but also from the fact that many of the cows that have aborted fail to breed again. Contagious abortion is probably caused by several different germs and is transmitted from one animal to another by contact, by means of the discharge from the cow that has been aborted, the afterbirth, dead calf, and from bulls that have served cows affected with the disease.

Symptoms.—Cows may abort any time, but it usually occurs from the third to the seventh month. Occasionally the early symptoms pass unnoticed, but in most cases there is some heat and enlargement of the udder, the vulva is somewhat swollen, and there is a discharge of white or yellowish mucus which is not like the normal transparent material which discharges during heat. After abortion the afterbirth is usually retained, giving rise to a very disagreeable discharge which continues for some time.

Treatment.—All suspected cows should be isolated from pregnant ones, and should any cows abort, the offspring and afterbirth should be burned or buried deeply and the stable thoroughly disinfected by the use of lime on the floor, after all the litter has been removed and burned. Then the woodwork should be disinfected with corrosive sublimate solution, using it in the proportion of one to one thousand. The tablets of corrosive sublimate may be secured at any drug store with directions for use. Ten days after the first disinfectant with corrosive sublimate all woodwork should be disinfected a second time. A week after the second disinfection the entire stable should be whitewashed.

Cows that have aborted should be washed out with a 1 per cent solution of creolin or lysol, continuing this daily until all discharge has stopped. Pregnant cows should be given sodium hyposulphite once daily in tablespoonful doses, as a drench. When cows abort in pasture, great care should be taken to burn the offspring on the spot where it dropped, and the immediate vicinity should be thoroughly limed.

As a precaution to prevent the spread of the disease in an aborting herd, it is well to disinfect the tails and also the vulva and immediate parts with a 5 per cent. creolin solution, to make sure of preventing the entrance of the germ into the womb. Bulls that have been with an aborting herd should not be allowed with healthy cattle; and to prevent their spreading the disease they should receive the same disinfection advised for cows. Cleanliness and the proper isolation and disinfection of cattle should be strictly adhered to in order to eradicate the disease.—*U.S. Bulletin.*

TWO WAYS OF TREATING TUBERCULOSIS IN HERDS.

H. L. Russell.

An actual demonstration is the best way to convince a person of the truth of any proposition, but in the matter of tuberculosis among stock it is impossible to make these before every farmer in the State, in order to show him the necessity of knowing the actual condition of affairs in his herd. If such a course could be followed, it would undoubtedly rouse every breeder of live stock to immediate action, as to whether his own herd was free or not from a disease that is the most serious menace to the cattle industry.

In the work of eradication and control of this disease among cattle, which is being carried on conjointly by the Wisconsin Live Stock Sanitary Board and the Agricultural Experiment Station, slaughter tests are continually being made by the state veterinarian, Dr. E. D. Roberts, so that farmers in different sections of the State may have the opportunity of seeing for themselves the diseased condition of animals that have reacted to the tuberculin test, but which from an inspection of their external condition would be regarded as perfectly healthy.

In this short bulletin the attempt is made to present actual findings as observed in the case of three herds, which demonstrate in the most forcible manner, the truth of the lesson that no farmer can afford to ignore this question and trust to luck as to whether his herd becomes affected or not. This can be done in no more emphatic way than to cite the history of these herds that have recently come under our observation. In two cases the wrong method has been followed. Herds in which losses have occurred have been allowed to go on without any attempt being made to learn whether the trouble was due to tuberculosis or not. To emphasise the

proper method of treatment, a single instance is cited to show how attention to this matter can save a herd from future disaster.

THE WRONG WAY.

I. RECORD OF A HERD, THE MILK OF WHICH WAS USED FOR A CITY SUPPLY.

One of the most extensive outbreaks of tuberculosis among cattle recently came to light in the herd of a prominent dairyman, supplying milk to the city of Beloit. The owner had a fine dairy farm on the outskirts of the city, and had constructed ample stable room to accommodate his herd. The business had developed until at the time of examination, seventy animals were kept, forty-six of which were then in milk. A veterinary examination of an animal somewhat out of condition revealed the presence of tuberculosis, much to the surprise of the owner, and the tuberculin test was then applied to the whole herd.

Fifty-seven in this herd of seventy reacted to the test. Those that escaped were for the most part young stock. Thirty-three of the best conditioned of these fifty-seven reacting animals were shipped to abattoirs for immediate slaughter and of this number only 18 passed federal inspection. Of the 24 killed on the farm not to exceed seven would have passed inspection for beef had they been sent in for slaughter. Thus it appears that 32 of the 57 that reacted were so badly affected as to require total condemnation of carcass.

HISTORY OF THIS HERD.

It was impossible to secure any very definite data as to the probable presence of this disease in the herd for the preceding years, as the owner was in California, but it was admitted by herdsmen who had handled the herd in previous years that a considerable number of animals had died or been killed from year to year as long ago as 1897. Frequently animals had been shot to get rid of them, as they pined away. No examination was made and the matter was allowed to drift on until the startling revelation was made by the use of the tuberculin test.

The slaughter of the herd revealed many cases of advanced tuberculosis, and in some instances even the udders were found diseased. Is it any wonder that the community was roused by such a discovery, for in this case where the milk of these animals was used directly for human food, the danger was much greater than if the same had been utilised in the manufacture of dairy products?

POOR VENTILATION.

An examination of the surroundings on the farm showed well constructed barns and stables, which were kept in a clean and sanitary manner, but no provision for ventilation was made, and this is undoubtedly the cause of the widespread dissemination of the disease. In the stable the organism of tuberculosis retains its vitality for many months, and where the barn is tightly built, with no system of ventilation, and is occupied by such a large herd, the conditions become ideal for the distribution of the disease germ from animal to animal if it once is introduced. In a thoroughly well ventilated barn, much of the diseased matter would be carried of in the polluted air, but where animals are forced to breathe the air over and over again

until it reeks with moisture, heat and material thrown off from the lungs, they become predisposed to the disease if the tubercle bacillus is present. Doubtless this condition was supplied by buying, in previous years, one or more animals having the seeds of the disease in their systems but not advanced far enough to permit of ready recognition.

When once introduced, time and environment did the rest, with the result that in the course of a few years it became necessary to destroy nearly all of the entire herd. How much better it would have been to have made this investigation several years ago. Any herd supplying milk as human food for direct consumption should be safeguarded against the possibility of this malady. *When public sentiment is finally aroused in such matters as this, cities will protect their citizens by requiring tuberculin tests to be made on all herds supplying milk for city delivery.* If large cities, like St. Paul, Minneapolis, and Duluth can do this for their citizens, cannot Wisconsin towns demand a similar protection? A few such illustrations as this would seem to be all that was needed. Others might be furnished if this was all that was necessary. Beloit is not the only town that has had the matter brought home to her in a striking way. Within the past three months two herds have been swept out of existence on account of tuberculosis, that were supplying milk for the people of the Capital City of the State.]

II. Record of a Herd, showing the most wide-spread development of Tuberculosis yet recorded in Wisconsin.

Within a week from the time this first herd was disposed of, another was examined in the southern part of the State in which even a worse condition was found. In this instance the herd consisted of 72 animals, many of which were fresh in milk, as the product was to supply a Swiss cheese factory. The condition of the stock revealed by the tuberculin test was shocking. Of the 72 animals tested, 69 reacted. Only one mature animal, a yearling bull, and a young calf escaped the disease.

This widespread distribution of the disease was found to be due to the usual cause, neglect and failure to provide proper sanitary surroundings. For several years the owner had been losing animals from time to time, but made no effort to learn the cause of the trouble. This last winter five died, the year before two others, and during previous years still others. Four years ago he sold to a neighbour five head of young stock, which were kept on pasture during the summer. In the fall they weighed less than when bought, and were condemned when shipped to Chicago. Later seven or eight others were bought for shipment, three of which were condemned when inspected. It would seem as if such experiences as these were sufficient to awaken the most indifferent stockman from his inaction, but in this case it required the complaint of the neighbours to force the owner to have the test applied. There is no question but that the disease had been spreading in the herd for a long time, taking its deadly toll each year, and infecting the young stock as they grew up. The *post-mortem* findings revealed many cases of generalised tuberculosis, some of which were in a most aggravated form. In a number of cases the udders showed well marked physical signs of disease. The development of the disease in young stock in both lung and body cavities, with the infection of the bowel itself, bespoke a double infection, through the milk as well as in the air. In fact, it rarely happens that a herd shows such a wholesale state of infection, but an inspection of the stable in which

the animals were kept revealed sufficient cause for the widespread dissemination of the disease in the herd.

RAPID SPREAD DUE TO UNSANITARY STABLE CONDITIONS.

The stable in which this entire herd of 70 head were kept, with about a dozen young calves from a few days to three or four weeks old, was located in a stone basement in which there was absolutely no provision for ventilation, nor adequete illumination. A little light filtered in through five or six tightly closed sash windows of three 8 x 10 inch panes of glass to each window. Even some of these so-called windows were boarded up. The interior of the stable was so dark that one could scarcely see to read ordinary newspaper print in the cow stable unless the doors were left open. Absolutely no attempt was made to ventilate the stable. The result was that during the night, when the stable was closed, the hot, stifling odour from the animals made the place almost unbearable. Added to these general unsanitary surroundings was the fact that the manure on the floor of the stable was over a foot in depth, and the reader can easily see how potent the environment must have been in the matter of predisposing the systems of the animals to the successful attack of the tubercle bacillus. Such conditions as these cannot produce the disease in the first place, because they cannot give rise to the specific germ producing the disease, but if once the disease germ is introduced, as it generally is by buying an animal affected in the early but unrecognised stages,* the influence of such general unsanitary surroundings can only hasten its spread from animal to animal. Such a condition is like dead underbrush and dry weather in a forest. If the match is applied the fire rages. The tubercle bacillus is the match, the real cause of the fire. Without it the disease cannot develop. But the fire fails to spread rapidly unless the conditions are suitable, and so the surroundings of the herd are of much import in the spread of the disease. Undoubtedly. failure to provide ventilation was the most potent of any of the factors contributing to such rapid spread in this case. The virus of the disease thrown out of the bodies of those affected in the later stages was distributed throughout the stable. In a closely confined air where no ventilation was had, this polluted atmosphere was breathed over and over again, thus continually reinfecting the animals, as well as lowering their general powers of resistance to the disease.

THE LESSON TO BE LEARNED.

The conditions described in the two foregoing cases are records of ignorance, apathy, and indifference. It matters not what the cause, the penalty is always the same. Slow wasting death is sure to occur, and blind, indeed, must be the stockman who will deliberately ignore such conditions. Some, doubtless, suffer losses more or less continually, and still remain ignorant of the fact that the worst possible disease is present in their herds. Others may surmise, if they do not positively know, that the disease is tuberculosis, but, ostrich-like, they prefer to remain blind to the fact, hoping it will die out of its own accord. Such kind of faith is rarely ever rewarded, except in the one inevitable way that the matter goes on from bad to worse, until frequently disaster overtakes the herd. If there was no satisfactory and sure way in which the disease could be recognised, there might be some excuse for such inaction, but when we have in the tuberculin

*The disease may be introduced into a herd through infected skim milk from a creamery or whey from a factory. One such case has come to light within the last few weeks. The rapid increase of the disease in hogs can only be accounted for in this way.

test,* a simple and effective agent which permits of the recognition of the disease in the earliest stages, long before it can be demonstrated by the physical symptoms, what stupendous folly to utterly neglect to apply such simple measures that will show with certainty whether a herd is diseased or not.

FORESIGHT VERSUS "HINDSIGHT."

The way these two herds just described have been handled is markedly contrasted with the course of action that was pursued in the following case. The first method cannot be condemned too strongly; the other cannot be recommended too highly.

THE RIGHT WAY.

A few weeks ago, a member of the Farmer's Course at the Agricultural College witnessed a demonstration of the tuberculin test, and while he had no reason to suspect the presence of the disease in his own herd, he went home with the thought that it would be prudent for him to apply the test and satisfy himself as to the actual condition of his own herd. In his herd of 25 only one was found affected, and this was a registered cow that had been bought a few months before for the sum of £30. This animal was the only recent purchase that had been made. In his laudable attempt to improve the character of his herd by using better stock, he had, unwittingly, introduced this dread plague in an unrecognised form. By the use of the tuberculin test, the condition was discovered in the nick of time. If he had not applied the test, the disease would have developed gradually until other animals had acquired it, and in the course of a few years, after he had spent time and money to improve his stock, he would have found his efforts frustrated by this insidious scourge.

Recently, another correspondent wrote that he applied the test to his herd, and found that three out of five registered Holsteins were affected that he had purchased a short time before at an expense of £300.

Such cases as these might be multiplied indefinitely, but they would not add to the forcefulness of the proof. No man who is engaged in the business of stock-raising, whether for general or dairy purposes, can afford to leave his herd untested. Even if he ignores entirely the public health aspect of the question (and this should be considered by the milk-producer) and regards the question purely from an economic point of view, every farmer should have his herd tested to ascertain its present condition. Finding his herd free, he should further test all new animals bought, so as to exclude the disease in this most common way of introduction. This disease is the most devastating animal plague with which Wisconsin farmers have to contend. Such conditions as have been presented are by no means so unusual that the lessons should be neglected. Of the seventy herds examined by the State Live Stock Sanitary Board for the years 1903 and 1904, 49 were found affected. Very frequently only a small number of reacting animals were found, but the appended list shows some startling cases of widespread infection.

* For the benefit of those who may not know exactly how the tuberculin test is applied, the following note is presented:—The temperature of the animal is taken per rectum several times during the day, so as to obtain the usual normal range which may sometimes fluctuate one or two degrees. By means of a hyopdermic syringe the tuberculin is injected during the evening, and the temperatures again taken about 10 hours after injection, this process being repeated at intervals of two hours for four or five times. If the temperatures after injection rise two or more degrees above the *average* normal and are maintained for some hours, the test is regarded as positive proof of the existence of tuberculosis lesions, although nothing can be foretold as to the extent of the disease in the animals. An unaffected animal shows no rise in temperature when subjected to such a test.

TABLE I.—*Instances of wide-spread infection of herds that have been tested in Wisconsin during 1903-1904.*

Date of Examination.	No. animals in herd.	No. found tuberculous.	Percentage affected.
Dec. 16, 1902	16	12	75
April 6, 1903	39	27	69
May 5, 1903	33	20	60
May 11, 1903	36	20	55
June 9, 1903	28	16	57
June 3, 1903	121	24	20
Oct. 22, 1903	56	25	44
Dec. 9, 1903	49	24	49
Mar. 21, 1904	55	27	49
Mar. 31, 1904	26	15	57
Apr. 17, 1904	30	23	76
Oct. 26, 1904	30	23	76
Jan. 5, 1905	27	21	77
Jan. 25, 1905	38	23	60
Feb. 5, 1905	14	12	85
Feb. 12, 1905	60	14	23
Mch. 20, 1905	20	13	65
Apr. 20, 1905	22	20	97
Apr. 25, 1905	70	57	81
May 3, 1905	31	21	69
May 8, 1905	92	31	33
	933	518	Aver. 55

If such widespread infection as these examinations indicate were found in all herds, the stock interests of the country would be on the verge of bankruptcy; and yet, the record above presented does not give by any means all of the cases. To eradicate such a plague after it has gained so strong a foothold costs many thousands of dollars each year to the stock owners and also to the State at large. Shall we sit idly by, as did the farmers of Denmark, where the disease became so widely spread that over 40 per cent. of all the animals tested showed its presence? The percentage present in our Wisconsin herds is doubtless less than five on the average. In over 3,000 head of Wisconsin milch cows tested a few years ago for shipment into Illinois, only two per cent. reacted.

Reader! How is it with your herd? Will you test it now—or later?

SUMMARY.

THE "LET ALONE" POLICY.

Two men neglected to heed the fact that they had lost animals in their herds from some slowly wasting disease. They had spent much time and money in building up their herds; one for a city milk supply, the other for a cheese factory, but they had ignored the fact that this dreaded scourge may lurk in apparently healthy bodies. Their herds looked well, although now and then they had lost an animal without any apparent cause. An application of the tuberculin test showed the true state of affairs, but this revelation was not made until *57 animals out of 70 in one case, and 69 out of 72 in the other* had contracted the contagion.

In estimating the loss in these two instances, one must figure not merely the actual value of the animals sacrificed, but the time and energy expended in building up a selected herd on a diseased foundation.

If these men had used the tuberculin tests years ago to ascertain *for certain* whether this insidious plague was present in *their* herds or not, thousands of dollars would have been saved.

THE RIGHT POLICY.

In this connection the record is also given of a farmer who took "time by the forelock" and demonstrated to his own satisfaction the actual condition of his own stock. His best cow was the only one found affected—an animal which he had bought a few months ago because she was the best example of the type he wanted. His herd was saved in the nick of time.

Any man engaged in the business of cattle breeding or raising who does not apply the tuberculin test as a safeguard against disease is running a chance of reaping trouble and disaster. Do you insure your farm buildings against fire? Why not use the tuberculin test as a cheap and effectual method of insurance against this widespread disease? So long as our farmers are content to let their herds go without finding out for certain whether this insidious disease is present or not, so long will the disease continue to thrive unrecognised. It will never be stamped out completely, unless stockmen are willing to investigate their own herds. If each one would do that, the numerous centres of infection that now lurk unrecognised would be revealed.

THE RELATION OF FOOD TO DAIRY PRODUCTION.

F. W. Woll.

During the period that has passed since most of the American experiment stations were established, some 20 years ago, an immense number of experiments have been conducted with a view of studying problems pertaining to the management of the dairy herd, the comparative value of different feeding stuffs or systems of feeding, and the like. The results of these investigations have been described in bulletins and other publications of the stations, which have been issued in a number of copies that has probably aggregated millions. From this Experiment Station alone there have been published on this subject during the period given 40 different bulletins in over 500,000 copies, besides the accounts of investigations in this line that will be found in our annual reports.

Under these conditions it might seem rather superfluous, at first thought, to publish another bulletin discussing the subject of feeding dairy cows, but a moment's reflection will suffice to convince any dairy farmer, at least, that the unsolved problems in dairying and dairy husbandry are still numerous, and the call for more light is as urgent as ever. New conditions

create new problems, and all the information that combined scientific knowledge and practical observation can furnish is needed and welcomed by progressive dairymen everywhere. As may be inferred from the figures given above, the study of dairy questions has formed an important part of the work of this Experiment Station, and justly so, it will be granted, when the importance of the dairy interests of the State are considered. The million dairy cows in this State at the last Census were worth at least 30 million dollars, and their annual produce was valued at nearly 27 million dollars. We ranked second in the production of butter and in the production of cheese, and fifth in the total value of dairy products, among all the State in the Union.

The present bulletin is published for the purpose of bringing before farmers a brief summary of recent experiments conducted at this and other stations that have a bearing on the production of milk and butter fat by dairy cows, and more especially of those dealing with the various factors which influence the economy of the production.

Cow-feeding experiments have been conducted at this Experiment Station during the last six years, since the establishment of the present dairy herd, for the study of the best system of feeding under our conditions for a large and economical production of milk and butter fat. The mass of data which have accumulated in this investigation have furnished excellent material for study and comparison of the value of different kinds of cows and systems of feeding for profitable dairy production. The main results of this investigation and of similar work done elsewhere will be briefly considered in the following pages.

FACTORS INFLUENCING ECONOMICAL MILK PRODUCTION.

The production of a cow is influenced in amount or character by a number of different factors, of which the following are the main ones:—

(*a.*) The inherent dairy qualities of the cow.
(*b.*) The quality of the milk produced.
(*c.*) The period of lactation.
(*d.*) The age of the cow.
(*e.*) The character and the amount of the feed rations.

(*a.*) The Inherent Dairy Qualities of the Cow.

We understand by this term the faculty of a cow to utilise the food eaten for dairy purposes, to respond to liberal feeding by yielding the largest amount of milk of which she is capable, without at the same time gaining materially in weight through formation and deposition of fatty tissue in her body. Cows differ greatly in this respect, and the difference between dairy cows and beef cows is based on this fact; the former class will utilise the food eaten in excess of what is required to carry on the bodily functions, for the production of milk; the latter will store muscle and fat on to their frames. Between these two classes of cows we find cows commonly known as *dual-purpose* or *farmers'* cows, which in a measure combine the characteristics of the dairy cow, in so far as a large production of milk is concerned, with those of beef cows, in that they produce calves that will make profitable feeders for beef raising. There has been considerable discussion of late years as to the value of dual-purpose cows for dairy production, one side maintaining that such cows have their proper sphere where a farmer can keep only a few cows and wishes to use the surplus roughage produced on

the farm for feeding steers; while the other looks on good milch cows of this class as more or less of freaks that cannot be depended upon to produce profitable dairy cows, and hence cannot be recommended for farmers that wish to maintain a dairy herd.

The question of the value of dual-purpose cows to the general farmer is still an open one which can be settled only by patient, painstaking observation as to the economy of their production and their power of transmission of hereditary characteristics. Cows of this class, like those of the large, robust type of dairy cows, have the advantage over much refined, small dairy cows in point of economy of production and in general greater constitutional strength. They consume less feed per unit of milk and butter fat produced than these, as a general rule, for the reason that their milk secretion is as large or larger than these and the amount of food eaten in excess of maintenance requirements is smaller because of their heavier weight.

There are great differences in the amounts of food materials required by dairy cows for the production of a unit of milk and butter fat. No farmer can appreciate how important this difference is until he weighs and tests the milk from the individual cows in his herd and determines with some degree of accuracy the amount of feed, especially of concentrates that his cows eat.

If the cows in our University herd be separated into three groups according to their average production during the years 1898-1903, and the average production of milk and butter fat per day, and the feed eaten by the cows in the different groups be summarised, we obtain the results shown in the following table; each group includes 11 cows:—

Comparison of high, medium and low producers.

Group.	Production.		Food Consumption.			Required for production of					
						100lbs. Milk.			1lb. Fat.		
	Milk.	Fat.	Dry matter.	Dig. protein.	Total dig. matter.	Dry matter.	Dig. protein.	Total dig. matter.	Dry matter.	Dig. protein.	Total dig. matter.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	ıbs.	lbs.	lhs.	lbs.
I.	28·1	1·23	24·9	1·97	17·0	89	7·0	60	20	1·6	14
II.	23·0	1·00	24·1	1·90	16·2	105	8·3	70	24	1·9	16
III.	17·9	·80	22·4	1·69	14·7	125	9·4	82	28	2·1	18
Average ...	23·1	1·01	23·7	1·85	16·0	103	8·0	69	24	1·8	16

(*To be continued.*)

GARDEN NOTES FOR OCTOBER.

By Percy G. Wicken.

The season has so far been a very favourable one for plant growth, and provided the rain does not cease too suddenly or too early in the season heavy crops should be obtained, both in the garden and on the farm. During last month a large range of vegetables should have been planted, but if for any cause this was not done, everything should be planted as early as possible this month so that the plants can get a good root hold of the ground before the hot weather sets in, and some warm days may be expected before the end of October. All the more delicate plants may be put out in the open this month and if they cannot be planted during showery weather they will probably require to be shaded from the sun until they have taken root. Weeds will, no doubt, be troublesome at this time of the year, but they should be hoed down as soon as they make any growth, and on no account be allowed to seed, as they only shed the seed and become worse the following year. The soil will require to be well stirred; this will keep the weeds in check and also help to conserve the moisture in the soil. In a small garden this work can be done by hand, but where larger areas are cultivated the horse hoe is a most useful implement for this purpose. Cut-worms, one of the gardener's worst enemies, are generally pretty active at the present time; they generally hide themselves in the ground during the day and at night eat round the stem of the plant, which causes it to wilt away, or to break off and die. The best remedy for this grub is to lay a small quantity of bait: Paris green, mixed with a little bran, round about where the grubs are troublesome, and this will poison them; but care must be taken that no domestic animals can get at this bait as it is an arsenical poison and will soon make short work of them. As a general rule all fungus diseases of plants should be sprayed with Bordeaux mixture, and all leaf or stem-eating insects with Paris green and water, but this should not be applied to plants shortly before sending to market. Any backward plants should be helped along by the application of a liquid manure—nitrate of soda or sulphate of ammonia dissolved in water; or, in the case of a larger crop, a top-dressing of either of these substances applied along the row and raked into the soil will have an almost immediate effect.

Artichokes (Jerusalem) can still be sown this month, although those sown earlier will, no doubt, give the best yields. The pieces of tubers may be planted out the same as potatoes, and they give a good yield.

Arrowroot.—Bulbs may still be planted out this month. The plant is both ornamental and useful. The bulbs or tubers, when cooked, make excellent feed for pigs. Plant in drills about four feet apart and two feet apart in the drills and manure well.

Beans.—French or kidney, snake, haricot, scarlet runners, etc., may all be planted out in large quantities this month. Beans are one of the most popular vegetables, and can be obtained in Perth almost all the year round. The main crops should be planted in September or early this month. Plant

in rows three feet apart and manure well with superphosphate and potash; cultivate well so as to keep the ground moist.

Beans (Lima).—This valuable bean may be sown in large quantities during this month. There are a large number of varieties; some of them are great climbers and require a trellis to grow on, other kinds are of the dwarf variety, but they are all excellent yielders and make a first-rate vegetable. If grown as a crop they should be planted in drills three feet apart and about 18 inches apart in the rows. They are well worth a trial.

Beet (Red).—A few rows can be sown to keep up a supply for the table.

Beet (Silver).—Cultivated for the supply of green leaves it supplies during the hot weather. Plant out all plants in seed bed, and a little more seed may be sown.

Cabbage.—Plant out any healthy young plants you may have, and if those already up are not doing well give them a top dressing of nitrate of soda, at the rate of 1cwt. per acre, dusted along the rows of plants but not touching the foliage.

Carrot.—Plant out a few rows to keep up a supply, those already up will require thinning out and weeding. The Shorthorn variety is a good one to sow.

Celery.—Plant out all forward plants in trenches so that they can be hilled up when they begin to grow; a little more seed can be sown.

Cucumbers.—May be planted in all parts. The hills should be dug deeply and well manured, about eight seeds sown in a hill and thinned out to four plants when they come up.

Egg Plants.—Plant out all young plants, and a little more seed may be sown.

Leeks.—A little seed may be sown.

Lettuce.—Young plants should be planted out and a little seed sown for future use.

Melons.—Look out for cut-worms on those plants already up. All kinds of melons may be sown largely this month. Water melons should be much more extensively cultivated than they are as they are much appreciated during the hot weather. Do not sow water melons and preserving melons in proximity to each other or they cross-fertilise. Preserving melons will grow with very little attention, but if well cultivated very heavy yields can be obtained.

Okras.—A few seeds may be sown; they are useful for pickles and flavouring.

Onions.—Any plants left in the seed bed may be planted out and a little seed planted for garden purpose. The onion beds already up must be kept free from weeds.

Parsnips.—A few rows may be sown to keep up a supply.

Potatoes.—If not already sown should be planted in moist localities at once; it is too late for the drier districts. Care should be taken that the seed is free from scab.

Pumpkins and Squashes.—Should be planted out largely during this month; they are a desirable plant to grow as the pumpkins can be stored

away and will keep most of the winter, and can be used either for table purposes or for stock. They should be planted out and treated the same as melons.

Sweet Potatoes.—Are a much neglected vegetable and worthy of more attention; plenty of cuttings or shoots should be now available, and they should be planted out on ridges as soon as possible so that they get a root hold before the hot weather sets in. They bear well and stand dry weather.

Tomatoes.—Early sown plants in the northern districts will be bearing fruit; the earliest tomatoes in the market always fetch a good price and those in the warmer districts have the advantage in this respect. In all parts of the State plants can be put out in the open, and all available plants should be put out as the fruit is a favourite one and always in demand. When the plants are staked and kept off the ground they are not so liable to be attacked by disease. A little seed may be sown for planting out later on.

Tumeric is a useful plant; the roots are used for flavouring soups, etc.; it is very similiar in habit of growth to ginger. Pieces of the root are planted the same as potatoes.

Farm.—The present not being a busy time on the farm, advantage should be taken of the warmer weather to get as much burning-off done before the close season as possible. Burning is prohibited after October 1st in the eastern districts and November 1st further south. Towards the end of the month the grass will probably be getting dry and the danger from bush fires has to be considered. The headlands of all paddocks should be cut for hay as early as possible and this piece of land ploughed up, which will then act as a fire-break and may possibly save the crop should a fire occur before the grain is harvested. The local agricultural shows will soon be coming on and every farmer should endeavour to make an exhibit of either some produce or stock from his farm on these occasions; it shows other people what he is doing and also tends to bring the district into prominence if a good display is made. Many settlers send their stock to the shows in a very rough condition. However good an animal may be, if he is not shown in good condition he does not catch the judge's eye. The time spent on grooming and attending to the animal for some weeks before show time will add much to his appearance. Shearing will be taking place in most districts, and if any number of sheep have to be dealt with it will pay to class the wool into several grades and tie the fleeces before baling up. As the grass becomes dry the poison plant makes a green growth and it is at this time that it is so dangerous to stock as the green shoot attracts the animals; a sharp look-out should be kept and all poison plants hoed out as soon as they appear.

If not already sown, the following plants can be sown as early as possible:—Maize (90 day), melons, pumpkins, sorghum, cow pea, soy beans, mangels, sugar beets, and millet.

Those interested in varieties of wheat and other kinds of grain would do well to pay a visit to one of the experimental farms or plots before harvest takes place and notice the growth of the varieties of wheat grown there and select varieties likely to suit their local conditions. Seed of most of the varieties grown can be obtained on application to the managers. The farms are open for inspection on week-days and information as to the crops or results of the fertilisers tried can always be obtained.

LOCAL MARKETS' REPORTS.

MESSRS. PATERSON & Co.'s (LTD.), REPORT.

Chaff.—During the month chaff has seen what is likely to be the highest price for the season, viz.:—£5 7s. 6d. for prime quality on rails Perth, with a couple of trucks at £5 10s., owing to exceptional circumstances. During the last week, supplies have come forward rather freely, plainly indicating that holders are now getting out of their stocks as rapidly as possible, without unduly depressing prices. Fair average quality has ruled as high as £5 2s. 6d., and medium quality up to £4 15s. and £4 17s. 6d. Cow chaff and damaged lots have been in fair demand, from £3 up to £4 5s., according to quality. There is not a great deal of time now left before we may expect to see new season's hay forward, and as several large parcels have still to be quitted, we may reasonably expect that prices will now recede, slowly perhaps, but still surely. It is possible to land imported chaff at under £5 per ton, so on this basis there is no reason in owners of chaff holding back any longer and taking the risk of a drop at the tail end of the season. Present prices are as follows:—Prime quality wheaten, £5 5s. to £5 7s. 6d.; fair average quality, wheaten, £5 to £5 2s. 6d.; good medium, wheaten, £4 15s. to £5; medium, £4 7s. 6d. to £4 12s. 6d.; cow chaff, £3 upwards, according to quality; prime quality oaten, scarce, £5 5s.; medium qualities, £4 15s. to £5 2s. 6d.

Wheat.—Prices have risen considerably for wheat during the month, a sharp rise of fully 5d. per bushel having taken place recently, and prime milling is now quoting and selling in large parcels at 4s. on rails on the country, equal to 4s. 4d. on rails Perth or Fremantle.

Oats.—During the month Algerian oats have risen considerably, the f.o.b. Melbourne quote now being as high as 2s. 0½d. for heavy feed samples. The local market has not yet responded fully to this, but is gradually raising prices, as earlier bought stocks diminish. Present quotes are: 2s. 7½d. for crushed Algerians, and 2s. 6d. for whole, with a prospect of an increase within a short time. White oats are quoting at 3s. 3d. whole, and 3s. 4½d. crushed, but as New Zealands are quoting fully 1½d. for B. grade samples over late prices, no doubt these will see a rise in the near future.

Hay.—Very little of this is showing. As prices have been so good for chaff, pressing has not been done to any great extent. Oaten hay, fit for racehorse food, is worth on the present market, £5 per ton, and wheaten hay, for stock feed, from £4 to £4 10s.

Bran and Pollard.—Melbourne quotes bran firm at 9d. f.o.b., Adelaide 9½d., and Sydney 10¼d. This latter is a rise on former values, on account of the dry weather there, and we may look for higher values on this market, should the weather conditions continue. Present quotations are: £5 7s. 6d. on rails Fremantle for imported bran, and £5 10s. on rails in the country for the local article, at which prices we have done considerable business during the last few weeks.

DALGETY'S MONTHLY REPORT.

Chaff.—We beg to report in connection with our daily auction sales of grain and chaff held in Perth and Fremantle, that during the past month the supplies have been fairly maintained, about 93 to 95 trucks a week have come forward, and the value realised for prime samples of wheaten has been from £5 7s. 6d. to £5 10s. per ton. The stock in sight at Perth on the 1st instant was about 575 tons, which is less by some 125 tons on the requirements. We consider the average consumption of Perth and its dependencies must be about 1,500 tons per month, so as far as one can judge the present requirements are in excess of the supply. Advices from farmers residing in the various districts, especially Katanning, Broome Hill, and Kojonup, state that there is a likelihood of there being a shortage in their crops for the coming season, in comparison with last season's output. Most of the farmers in the aforementioned districts have been unable to get all their crop in owing to the heavy rains in May

last having hampered their seeding operations. The crops in the high grounds appear to be very healthy, but the frosts of late have impeded their progress, but owing to the favourable conditions of the weather of late these appear to have picked up, and the prospect is better than it was three or four weeks ago. During the month the arrivals of chaff were composed mostly of fair average quality, and sound medium wheaten. The supply of prime wheaten seems to have diminished; the goldfields being considered the best maket, and in consequence most of the prime samples have been forwarded in that direction.

At Fremantle the market has been very firm during the whole month, the prices realised have been equal, and at times 2s. 6d. per ton in excess of those ruling at Perth, but we would not advise holders to make any large consignments to Fremantle at one time as the demand is only small, and very few trucks would "swamp" the market.

Prices realised have been as follows:—Prime green wheaten, from £5 7s. 6d. to £5 10s. per ton; f.a.q. from £5 to £5 5s. per ton; good medium wheaten, from £4 12s. 6d. to £4 17s. 6d. per ton; inferior sorts (including cow chaff), from £3 to £4 2s. 6d. per ton.

Very few samples of oaten chaff have been handled during the month, and each lot was eagerly competed for by the buyers, who we beg to report were in large attendance at every sale. The market now is firm, and has every prospect of remaining in the same state until the new season's supplies come to hand.

Wheat.—Our Melbourne advices state that several large transactions have been made in wheat, especially towards the end of the present month. Some 3,000 bags changed hands during the last week at from 3s. 6½d. per bushel. The market there is firm, from 3s. 6¼d. to 3s. 6½d. per bushel.

Local Wheat.—The supply of local wheat during the month has greatly diminished, also has the demand, as millers appear to have bought all their requirements, and the demand is only for local consumption. Several trucks towards the end of the month have been disposed of at the highest prices received during the season, namely, 4s. 4d. to 4s. 4½d. per bushel on trucks; smutty samples have brought from 4s. 1d. to 4s. 2d. per bushel. Holders in the country would do well in consigning their supplies to the market in small consignments, as ready competition is experienced.

Straw.—During the month only small quantities of straw came to hand, and the prices realised were from £2 to £2 15s. per ton on rails Perth and Fremantle. Towards the letter end of the month three trucks were sold at these prices, namely, £2 15s. per ton.

Hay.—The demand for hay at the present time is absolutely *nil*; no business is being recorded during the period under review.

Algerian Oats.—Large sales have been reported from Melbourne, and local buyers have arranged for shipments per "Kanowna" at the cheap rates of freight. During the month several rises have been reported in the market, oats now being quoted (good stout bright feed) at 2s. to 2s. 1d. per bushel f.o.b. Melbourne.

The local holdings are exceptionally small, and the demand is in excess of the amount held on spot. Holders at the present time are asking from 2s. 6½d. to 2s. 7½d. per bushel f.o.r., whole and crushed. We have large shipments arriving per "Kanowna," due here about 9th instant. These were bought on a fair market, so there is not much likelihood of prices fluctuating too much until the present shipment is cut out.

Bran.—Latest quotations for bran from Adelaide state that the local millers are quoting 9½d. to 10d. per bushel.

Pollard.—11½d. to 1s. per bushel f.o.b.

The W.A. Producer's Co-operative Salerooms, Ltd., Report.

The W.A. Producer's Co-operative Salerooms, Limited, reported under yesterday's date:—Our rooms were pretty well crowded with vegetables and other produce of all kinds. There were very large quantities of cabbage forward, and no doubt, owing to the good prices lately being obtained, there were considerable quantities of root lines forward, these, on the average, realising very satisfactory prices. Cauliflowers were rather scarce, and top prices were realised for anything prime: in fact, the market cleared up at very good prices for this line. Large quantities of pumpkins and swedes

forward; there was only a fair demand, and several lines had to be passed in. Celery and other salads cleared off at rates about equal to last report. Fruit: There was a very good demand for local apples and oranges; we cleared up these at very satisfactory prices. We had large quantities of carcase pork, and prices were well maintained for this line. Eggs were a little firmer. Fruit: Apples, local Yates 14s. 9d. to 16s. 3d.; Rokewoods, 11s. to 15s. 6d.; Stone Pippins, 6s. to 11s. 6d.; Rome beauties, 14s. to 15s. 6d.: imported Sturmers, 8s. to 8s. 9d.; French Crabs, 9s. to 9s 6d. Oranges, 7s. 6d. to 9s. 6d. Mandarins, 12s. to 18s. Loquats, 5s. to 6s. 3d. quarter-case. Lemons, 4s. 6d. to 6s. 6d. Cape goosberries, 4d. to 4½d. Eggs: Guaranteed lots, 1s. to 1s. 1d. Carcase pork, from 4½d. to 5½d. Vegetables: Cauliflowers, prime, 10s. to 12s. 6d., medium, 6s. to 9s. 6d., small, 3s. to 5s. 6d.; cabbage, prime, 9s. 6d. to 10s. 3d., medium, 8s. to 9s. cwt., others from 3s. 6d. to 9s. bag; pumpkins, bugle, 2s. 6d. to 3s. cwt., ironbark, 4s. 6d. to 5s. 6d. cwt.; swede turnips, 9d. to 1s. 9d. dozen, bulk, 4s. to 5s. 6d. cwt.; turnips, 1s. to 2s. 1d. dozen; carrots, 8d. to 1s. 3d. dozen; parsnips, 1s. 6d. to 2s. 3d. dozen, bulk, 3s. to 4s. small bag; beetroot, 1s. 6d. to 2s. 6d.; rhubarb, 2½d. to 3½d.; celery, prime, 3s. to 4s. dozen, medium, 1s. 6d. to 2s. 6d.; spinach, 1s. 9d.; peas, 3½d. to 4½d.; silver beet, 1s. 6d. to 2s.; Chinese radishes. 6d. to 1s. 3d.; lettuce, 6d. to 1s. 9d.; broad beans, 2½ lb.; radishes, 2d. to 4d. dozen; spring onions, 3d. to 6d. bunch; parsley, 1d. to 3d. bunch; mint, 2d. to 3½d. bunch; watercress, 2d. to 3d.; leeks, 1s. to 1s. 3d.; new potatoes, 13s. 6d. to 14s., small, 10s. cwt., imported, 11s.; onions, 22s. cwt. Poultry: Best table coops, 5s. 3d. to 5s. 9d., others, 4s. 6d. to 5s.; ducks, 5s. to 6s.

The PERTH FRUIT AND PRODUCE EXCHANGE REPORT.

The Perth Fruit and Produce Exchange report under yesterday's date:—Notwithstanding the bad weather prevailing, our room was again well supplied with all kinds of fruit and garden produce. The attendance of buyers was good, and fair competition; prices for prime limes firm. Prime local oranges, 8s. 6d. to 9s. 6d.; medium, 7s.; small, 6s. to 7s.; windfalls, 5s. to 5s. 6d.; prime Navels, 12s. to 14s.; imported, 13s. to 14s.; square cases oranges, 7s. to 10s. Local apples, prime, are worth 15s. to 16s.; medium, 10s. to 12s.; inferior, 6s. to 8s.; imported lines, firm; Sturmers, 10s.; Stone Pippins, 9s. 6d. to 10s.; Crabs, 9s. 3d. to 9s. 6d.; good coloured stuff, 11s. to 14s.; Prime bananas, 23s. to 25s.; green, 22s.; medium, 16s. to 17s.; square cases, 9s. 6d. to 13s. Loquats, ½-cases, 10s. to 11s. 6d. ¼-cases, 4s. to 5s. Passion fruit, 15s. to 16s., ½-cases, 7s. 9d. Prime lemons, 5s. to 6s.; medium, 4s.; inferior, 2s. Pomeloes, 2s. to 3s. doz. Cape gooseberries, 4d. Mandarins, 15s. to 16s. Citronells, 1s. to 2s. case. All other lines at usual prices. Full supplies vegetables forward, and prime lines very firm. Peas, 3d. to 5½d. French beans, 4d. to 7d. Rhubarb, 2¼d. to 2¾d. Sweet potatoes, 2½d. Artichokes, 2¼d. Horseradish, 6d. to 7d. Chilies, 9d. Garlic. 6d. lb. Carrots, 1s. 3d. to 2s. Turnips, 1s. 6d. to 2s. 5d. Beetroot, 2s. to 2s. 6d. Parsnips, 1s. to 1s. 10d. Swedes, 1s. to 1s. 6d.; loose, 5s. cwt. China radish, 1s. 6d. to 2s. Spring onions, 3d. to 9d. Leeks, 1s. Spinach, 9d. to 1s. 3d. Radish, 6d. to 9d. Celery, 1s. to 2s. to 3s. 6d. Parsley, mint, and watercress, 1s. 6d. to 2s. 3d. doz. Lettuce, 1s. to 2s. Ironbark pumpkins, 5s. 6d. to 6s. 6d., bugles, 3s. to 3s. 6d. Victorian potatoes, 10s. 6d.; Tasmanian, 11s. 9d. to 12s. 6d. Onions, 16s. case. Prime cabbage, 11s. to 12s. cwt.; medium, 8s. to 10s.; inferior, 3s. to 5s.; savoy, 8s. to 10s.; pickling, 7s. 6d. Small cauliflowers, 11s. to 12s.; medium, 1s. to 9s.; small, 5s.; inferior stuff, from 1s. 6d. Fresh laid eggs, 1s. 3d. to 1s. 4d.; country lots, from 10d. doz. (market glutted). Good lines poultry offering. Prime ducks, 8s. 6d.; medium, 6s. 6d. to 7s. 6d. Fowls, 6s. 6d.; medium, 5s. to 5s. 9d. Pigeons, 1s. 6d. to 2s. pair; Turkeys, young, 10s. 6d. to 13s. pair.

KALGOORLIE PRODUCE MARKET.

Messrs. Cheney and Co. report that the following prices were realised at their sales to-day:—Local apples, 12s. to 14s.; imported do., 11s. to 15s.; local oranges, 11s.; Navel do., 15s.; mandarins, 19s.; bananas, 26s.; rhubarb, 2½d.; peas, 6d.; celery, 3d.; lettuces, 9d.; large do., 2s., beetroot, 2s. 9d.; turnips, 2s.; carrots, 1s. 9d.; parsnips, 2s. 9d.; prime cabbages, 20s.; inferior do., 12s.; swedes, 5s. to 10s.; cauliflowers, 3s. to 10s.; new potatoes, 16s.; eggs, 1s.; fowls, 6s. to 7s.; ducks, 8s. 6d.; turkeys, 20s.; pork, 6½d.; honey, 3d.

PERTH FRUIT AND PRODUCE EXCHANGE REPORT.

The Perth Fruit and Produce Exchange Auctioneers and Produce Salesmen, 387 Murray Street, report that business during the past month has fallen off considerably, owing to the shortage of supplies at this time of the year. The demand for all kinds of prime fruits and vegetables is very firm, and the growers who are fortunate enough to have marketable stuff, have no cause to complain about the prices obtained for their lines. The undermentioned are a few prices obtained at our sale to-day, Friday, 8th September; these figures are about double the price the same lines were bringing three weeks ago. This advance is only accounted for by the short supplies and not in any way due to better selling conditions. Local apples from 11s. to 16s.; oranges, 8s. to 9s. 6d.; navals, 10s. to 14s.; mandarins, 15s. to 16s.; imported apples, 9s. 6d. to 11s.; lemons, 5s. to 5s. 6d. Cabbage, 10s. to 13s. cwt.; cauliflowers, 9s. to 11s. 6d. dozen; bunched roots, 1s. 6d. to 2s.; peas, 5d. to 6d.; French beans, 4d. to 6d.; celery, 3s. to 4s. doz.; new potatoes, 14s. to 17s. per cwt. Poultry: Ducks, 7s. 6d. to 8s. 6d.; fowls, 5s. to 6s. 6d.; young turkeys, 10s. 6d. to 14s. per pair.

H. J. WIGMORE & CO.'S REPORT.

In connection with our daily auction sales of chaff in Perth and Fremantle, we have to submit the following report for month ending 8th inst.

Perth chaff market remains in the same healthy state as when we last reported to this journal, and there is very little alteration to report in values, which are gradually advancing as the season goes on. Supplies have been arriving somewhat more freely during the month, an average of about 100 trucks per week coming to hand; but the comparatively heavy yardings which have occurred from time to time have had no effect on Perth prices, owing to the continued brisk demand for chaff from country districts. We quote an instance of this by stating that on one day alone (Monday, 4th inst.) out of a yarding of 44 trucks, 36 were railed away to various country centres, such as Bunbury, Kelmscott, Armadale, etc. This is enormous, and easily explains the firmness of Perth market. We quote closing values as follow:—Prime green wheaten (market very bare), £5 10s. upwards; f.a.q. wheaten, £5 7s. 6d., good medium wheaten, £5 2s. 6d. to £5 5s.; irregular wheaten (according to quality and condition), £5 to £5 7s. 6d.; low medium wheaten £4 12s. 6d. to £4 15s. Prime oaten chaff (very scarce) is worth £5 10s. We are satisfied that chaff will see yet higher prices before the new season commences, which will probably not be for about another two months, and the tone of the market can be realised by the fact that £5 5s. was paid freely this week for inferior and damaged chaff, which very recently we have had extreme difficulty in selling up to £5. Very few trucks have been arriving in Fremantle during the month, and this market remains firm on the basis of Perth prices. We have sold largely to the Goldfields from Northam during the month at higher equivalents than Perth prices.

With regard to the Goldfields we wish to make the following special announcement to our farmer friends:—On 1st November next we are opening a branch of our business at Kalgoorlie under the management of Mr. R. Paton, who last year travelled through from Katanning and upwards in our interests. Mr. Paton thoroughly understands the chaff and grain trade, and farmers who consign chaff, etc., to us at Kalgoorlie can be quite sure that their interests will be thoroughly conserved in Mr. Paton's capable hands. The same attention as to the securing of highest possible prices and promptitude of returns, which have placed us in the front rank as chaff and grain auctioneers, will be observed by our Kalgoorlie branch.

Wheat.—Has firmed considerably during the month, and we have to report having sold heavily on the basis of 4s. to 4s. 0½d. country centres, equal to 4s. 5d. Perth or Fremantle. Four shillings and fivepence has also been obtained at auction in one instance for a truck-load of prime milling. Slightly higher prices may still be expected in this commodity.

Hay and Straw.—We have little or no business to record.

Bran Bags and Cornsacks.—Continue very firm. Farmers requiring cornsacks are recommended to communicate at once regarding same. Apparently those farmers who are now prepared to purchase bran bags also for forward delivery will act wisely.

Flour.—A sharp rise has occurred in South Australia and Thomas' Standard sacks are now quoted at £8 f.o.b. Port Adelaide. We have our usual sales to record. On

rails Northam we quote sacks, £8 5s., quarter sacks, £8 10s., and report a brisk demand and heavy deliveries during the month.

Algerian Oats.—Melbourne has risen considerably and Good Heavies are now worth 2s. for prompt and 2s. 1d. for forward shipment. Our advices from Melbourne point to still higher prices in the near future. The rise has hardly been reflected here, and prices on spot are 2s. 6d. to 2s. 7d. for Good Heavy Feed Whole, and 2s. 7½d. to 2s. 8d. for crushed on rails Fremantle.

New Zealand Oats have also firmed considerably and B Grades are now quoted at 2s. f.o.b.

Bran and Pollard.—The market is easy on spot for these commodities £5 7s. 6d to £5 10s. being ruling price on rails Fremantle for Bran, and Pollard, £6, to £6 5s. Northam and other supplies are very short.

THE CLIMATE OF WESTERN AUSTRALIA DURING AUGUST, 1905.

At the beginning of the month the weather was cloudy and unsettled throughout the entire State, and heavy rain fell in the North-Western districts between Condon and Nullagine, succeeded by a rapid fall in the barometers in South-Western districts with severe gale and unusually high seas.

During the remainder of the month the weather was of a fairly normal character, occasional "lows" passing along the Southern Ocean from West to East, accompanied by rains in South-West and Southern portions, interspersed with "highs" and finer weather.

On the whole the rainfall, with the exception of that in some parts of the North-West, was below the average for previous years, the deficiency being especially noticeable in South-West coastal districts.

Pressure was generally from 0·05 to 0·10 above normal, and temperature was considerably below the mean for previous years throughout the Southern half of the State. Frosts were occasionally reported, and the following table shows the mean and absolute lowest readings of a minimum thermometer placed upon the surface of the ground:—

Station.	Mean.	Lowest.	Date.
Peak Hill	39·0	30·0	4
Cue	38·6	32·0	12
Coolgardie	33·0	24·6	11
Southern Cross	32·8	24·5	11
Walebing	32·0	23·0	11
York	31·6	24·0	13
Perth Observatory	41·6	30·5	13
Wandering	30·5	26·0	11
Bridgetown	33·2	24·0	21, 30
Narrogin	33·6	24·0	28
Karridale	40·9	28·2	30
Katanning	31·5	23·0	13
Mount Barker	35·9	29·0	14, 21

The Climate of Western Australia during August, 1905.

Region	Locality	Barometer (corrected and reduced to sea-level). Mean of 9 a.m. and 3 p.m.	Barometer: Average for previous years	Barometer: Highest for Month	Barometer: Lowest for Month	Shade Temperatures, August, 1905: Mean Max.	Aug. 1905: Mean Min.	Aug. 1905: Mean of Month	Aug. 1905: Highest Max.	Aug. 1905: Lowest Min.	Average for previous Years: Mean Max.	Avg.: Mean Min.	Avg.: Highest ever recorded	Avg.: Lowest ever recorded	Rainfall: Points (100 to inch) in Month	Rainfall: Wet Days	Rainfall: Total Points since Jan. 1
North-West and North Coast:	Wyndham	30·020	30·006	30·145	29·883	89·3	70·1	79·7	98·0	60·0	89·4	69·1	96·8	56·2	1	1	1,081
	Derby	30·028	30·005	30·138	29·891	89·6	61·0	75·3	98·0	54·2	89·1	59·6	98·6	45·2	70	2	1,475
	Broome	30·026	30·016	30·146	29·845	86·8	61·5	74·2	96·2	53·0	85·4	58·2	98·8	43·0	52	1	609
	Condon	30·064	30·052	30·210	29·832	81·4	54·4	67·9	89·8	47·0	80·9	52·0	95·2	37·0	176	1	850
	Cossack	30·076	30·064	30·212	29·871	80·8	57·6	69·2	89·8	50·0	80·7	55·9	92·8	45·8	2	1	837
	Onslow	30·092	30·068	30·209	29·907	80·5	52·4	66·4	93·0	43·0	79·1	52·6	90·5	40·0	23	2	607
	Winning Pool ...	...	...	...	...	...	...	...	...	...	...	...	...	...	24	2	838
	Carnarvon	30·122	30·112	30·280	29·960	74·3	52·9	63·6	88·2	40·0	72·7	52·2	90·2	40·5	23	4	975
	Hamelin Pool... ...	30·150	30·104	30·388	29·968	72·2	47·2	54·7	79·2	38·0	71·4	48·2	83·0	35·7	57	6	806
	Geraldton	30·178	30·027	30·446	29·821	70·2	48·9	59·6	81·0	37·6	69·1	50·4	84·8	38·9	197	12	1,597
Inland:	Hall's Creek	...	30·050	...	...	...	...	...	...	...	86·0	51·7	95·2	32·8	*Nil*	...	488
	Marble Bar	...	...	...	...	84·0	56·7	70·4	91·5	46·5	85·1	54·0	95·0	39·0	81	2	886
	Nullagine	30·146	30·080	30·328	29·873	79·6	48·1	63·8	85·6	38·5	79·5	46·8	92·0	30·1	108	1	576
	Peak Hill	30·175	30·108	30·430	29·800	69·0	45·0	57·0	81·0	41·0	70·4	47·0	83·8	36·4	8	1	450
	Wiluna	30·175	30·117	30·455	29·815	67·8	38·5	53·2	81·2	29·3	67·7	43·0	85·8	31·3	10	1	533
	Cue	30·168	30·132	30·443	29·827	66·9	42·5	54·7	78·6	35·2	69·5	45·9	86·0	31·0	56	4	655
	Murgoo	...	...	...	...	69·3	44·2	56·8	80·5	37·0	...	...	...	...	49	4	462
	Yalgoo	30·171	30·124	30·420	29·800	67·0	43·0	55·0	82·2	35·0	68·2	44·1	85·3	31·5	64	3	824
	Lawlers	30·202	30·128	30·480	29·860	...	...	...	79·6	34·2	68·0	44·6	85·2	31·5	42	3	673
	Laverton	30·208	30·152	30·596	29·753	65·0	39·1	52·0	79·2	30·8	68·4	43·3	87·1	27·0	13	2	655
	Menzies	30·168	30·132	30·566	29·728	63·4	39·9	51·6	75·9	33·0	65·7	44·5	83·8	29·7	81	2	534
	Kanowna	...	...	...	...	61·5	38·6	50·0	71·2	33·2	...	...	...	...	55	4	465
	Kalgoorlie	30·193	30·136	30·597	29·679	63·0	40·0	51·5	77·2	34·8	65·1	44·6	82·0	34·0	52	5	448
	Coolgardie	30·184	30·133	30·591	29·645	62·3	39·3	50·8	76·0	32·4	64·9	43·5	81·0	31·2	54	4	514
	Southern Cross ...	30·191	30·116	...	29·653	63·9	37·3	50·6	79·8	27·0	64·9	41·1	81·0	25·0	45	3	481
	Kellerberrin	...	...	...	...	...	...	...	...	...	...	...	...	...	119	10	857
	Walebing *	...	...	...	...	61·5	38·6	50·0	74·0	31·0	64·6	41·7	78·9	31·4	201	13	1,503
	Northam*	...	...	...	...	62·5	37·1	49·8	74·6	30·8	65·9	40·5	80·1	31·8	256	11	1,448
	York	30·195	30·127	30·540	29·662	61·8	37·1	49·4	72·0	30·4	64·4	41·3	79·1	29·8	248	12	1,602
	Guildford	...	...	...	...	63·6	43·6	53·6	74·4	34·4	66·8	44·6	81·6	30·2	382	11	3,598

* Averages for three years only.

The Climate of Western Australia during August, 1905—*continued.*

Locality.	Barometer (corrected and reduced to sea-level). Mean of 9 a.m. and 3 p.m.	Average for previous years.	Highest for Month.	Lowest for Month.	Shade Temperatures. August, 1905. Mean Max.	Mean Min.	Mean of Month.	Highest Max.	Lowest Min.	Average for previous Years. Mean Max.	Mean Min.	Highest ever recorded.	Lowest ever recorded.	Rainfall. Points (100 to inch) in Month.	Wet Days.	Total Points since Jna. 1.
South-West and South Coast :																
Perth Gardens	30·187	30·112	30·521	29·510	62·9	45·7	54·3	72·0	38·4	65·2	47·1	79·7	33·6	349	12	2,531
Perth Observatory ...	30·196	30·122	30·528	29·506	62·3	45·6	54·0	72·3	38 9	64·1	47·9	80·4	37·5	350	16	2,582
Fremantle	30·212	30·100	30·533	29·640	61·8	48·3	55·0	73·0	41·8	63·6	51·0	77·3	41·0	332	13	1,926
Rottnest	...	30·090	...	...	...	...	...	...	...	63·2	53·4	76·2	46·2	...	...	...
Mandurah	...	...	...	...	61·8	42·5	52·2	70·3	32·3	64·9	45·2	76·2	33·8	468	12	3,149
Marradong	...	...	...	...	...	...	...	...	...	...	...	...	...	346	10	2,391
Wandering	...	...	...	...	61·6	29·0	50·3	68·0	30·6	...	...	...	...	346	8	2,223
Narrogin	...	...	...	...	56·0	37·4	46·7	68·5	31·0	...	...	...	...	192	12	1,777
Collie	...	...	...	...	60·4	34·6	47·5	69·8	27·0	62·2	38·2	75·7	29·0	309	13	2,729
Donnybrook	...	...	...	...	60·7	39·7	50·4	70·4	29·0	64·2	44·8	74·2	32·1	345	13	3,024
Bunbury	30·211	30·111	30·542	30·550	60·6	43·5	52·0	66·0	36·0	63·9	46·9	75·5	33·2	303	11	2,667
Busselton	...	...	...	...	60·9	41·7	51·3	69·0	35·0	62·5	45·5	73·8	33·6	234	16	2,148
Cape Naturaliste ...	30·169	...	30·538	30·442	58·1	48·1	53·1	66·5	38·8	...	...	...	...	315	19	2,304
Bridgetown	...	...	...	...	59·7	37·0	48·4	69·0	28·0	62·6	39·6	75·9	28·2	332	17	2,245
Karridale	30·164	30·092	30·542	30·401	56·1	44·2	50·2	68·0	33·2	62·0	46·4	74·4	32·5	389	25	3,467
Cape Leeuwin	30·128	30·043	30·518	30·177	59·3	51·3	55·3	67·0	44·5	61·8	52·5	72·3	43·8	319	21	2,927
Katanning	30·174	30·103	30·579	30·571	57·9	38·1	48·0	66·0	30·0	60·2	41·3	75·1	30·8	156	12	1,441
Mt. Barker	...	...	...	...	56·4	39·8	48·1	67·0	32·3	...	...	...	...	223	14	1,731
Albany	30·130	30·069	30·573	30·430	59·2	44·0	51·6	71·5	34·0	61·7	45·8	77·5	34·5	495	22	2,374
Breaksea...	30·120	30·058	30·611	30·256	56·8	47·3	52·0	68·8	39·3	59·8	49·8	74·8	34·5	362	23	2,287
Esperance	30·186	30·098	30·694	30·533	60·6	42·7	51·6	74·0	33·0	64·1	46·8	82·8	34·8	382	15	1,991
Balladonia	30·181	30·151	30·644	30·577	62·8	37·4	50·1	73·0	28·0	65·3	41·6	83·0	31·5	37	4	423
Eyre	30·166	30·132	30·597	30·595	64·4	42·4	53·4	78·6	31·0	64·8	43·8	88·7	29·1	49	7	573
INTERSTATE.																
Perth	30·196	30·122	30·528	30·506	62·3	45·6	54·0	72·3	38·9	64·1	47·9	80·4	37·5	350	16	2,582
Adelaide	30·167	30·125	30·639	30·700	59·5	43·4	51·4	69·8	34·8	62·0	45·8	82·0	32·3	148	15	1,780
Melbourne	...	29·981	...	...	...	...	...	...	...	58·8	43·2	77·0	28·3	123	13	1,808
Sydney	30·160	30·103	30·500	30·630	62·0	46·0	54·0	77·0	40·0	62·2	47·5	82·0	36·8	63	6	2,686

The Observatory, Perth, 9th September, 1905.

W. E. COOKE, Government Astronomer.

RAINFALL for July, 1905 (completed as far as possible), and for August, 1905 (principally from Telegraphic Reports).

Stations.	July. No. of points. 100 = 1in.	July. No. of wet days.	August. No. of points. 100 = 1in.	August. No. of wet days.
East Kimberley				
Wyndham ...	Nil	...	1	1
6-Mile	...	...	...	...
The Stud Station	...	...	...	...
Carlton	Nil	...	Nil	...
Denham	...	...	...	...
Rosewood Downs	Nil	...	...	...
Argyle Downs ...	...	...	...	...
Lisadell	...	...	...	...
Turkey Creek ...	Nil	...	74	4
Ord River ...	...	...	...	...
Alice Downs ...	...	...	...	...
Hall's Creek ...	Nil	...	Nil	...
Nicholson Plains	...	...	...	...
Flora Valley ...	...	...	...	...
Ruby Plains ...	...	...	...	...
Denison Downs...	...	...	...	...
West Kimberley:				
Obagama ...	23	1	...	...
Beagle Bay ...	...	...	...	...
Pt. Torment ...	...	...	...	...
Derby	38	1	70	2
Yeeda	...	...	...	...
Liveringa ...	...	...	...	...
Mt. Anderson ...	...	...	...	...
Leopold Downs...	...	...	...	...
Fitzroy Crossing	Nil	...	Nil	...
Fitzroy (C. Blythe)	...	...	...	...
Quanbun ...	...	...	...	...
Nookanbah ...	...	...	...	...
Broome	25	1	52	1
Roebuck Downs	...	...	...	...
Thangoo	...	...	...	...
La Grange Bay...	40	2	60	1
North-West:				
Wallal	43	1	75	1
Condon	39	1	176	1
Pardoo	...	...	...	...
DeGrey River ...	...	...	...	...
North-West—*cont.*				
Port Hedland ...	25	1	163	2
Boodarie ...	26	1	...	...
Warralong ...	...	...	...	...
Muccan	...	...	...	...
Ettrick	...	...	...	...
Mulgie	...	...	...	...
Eel Creek ...	...	...	...	...
Station Peak ...	3	1	...	...
Coongon	...	...	...	...
Warrawagine ...	...	...	...	...
Bamboo Creek ...	25	1	112	1
Marble Bar ...	20	2	81	2
Warrawoona ...	14	1	92	1
Corunna Downs...	...	...	...	...
Nullagine ...	2	1	105	1
Mt. Edgar ...	...	...	...	...
Kerdiadary ...	Nil	...	...	...
Roy Hill	...	...	...	...
Middle Creek ...	Nil	...	...	...
Mosquito Creek...	13	1	...	...
Mulga Downs ...	...	...	...	...
Woodstock ...	...	...	...	...
Mt. Florence ...	...	...	...	...
Tambrey ...	...	...	...	...
Millstream ...	...	...	...	...
Yandyarra ...	...	...	...	...
Mallina	10	1	...	...
Whim Creek ...	Nil	...	24	2
Cooyapooya ...	...	...	...	...
Woodbrooke ...	...	...	...	...
Croydon	Nil	...	...	...
Balla Balla ...	...	...	...	...
Roebourne ...	1	1	2	1
Cossack	2	1	2	1
Sherlock ...	Nil	...	...	...
Fortescue ...	Nil	...	22	2
Mardie	...	...	...	...
Mt. Stewart ...	...	...	...	...
Yarraloola ...	...	...	...	...
Chinginarra ...	...	...	...	...
Onslow	12	1	23	2
Peedamullah ...	...	...	...	...
Red Hill	...	...	...	...
Mt. Mortimer ...	...	...	...	...
Peake Station ...	...	...	...	...
Wogoola ...	...	...	...	...

RAINFALL—*continued.*

Stations.	July. No. of points. 100 = 1in.	July. No. of wet days.	August. No. of points. 100 = 1in.	August. No. of wet days.
North-West—*cont.*				
Nanutarra ...	...	...	...	...
Yanrey	...	...	...	...
Point Cloates ...	159	4	...	...
Edmunds ...	...	...	...	...
Gascoyne:				
Winning Pool ...	53	3	24	2
Coordalia ...	...	...	...	...
Towara	11	2	...	...
Ullawarra ...	...	...	...	...
Maroonah ...	...	...	...	...
Gifford Creek ...	...	...	...	...
Thomas Police Station	...	...	...	...
Bangemall ...	...	...	...	...
Mt. Augustus ...	...	...	...	...
Minnie Creek ...	33	1	...	...
Yanyeareddy ...	...	...	...	...
Williambury ...	61	3	...	...
Booloogooroo ...	...	...	...	...
Wandagee ...	...	...	...	...
Bernier Island ...	...	...	...	...
Boolathana ...	69	3	...	...
Carnarvon ...	27	3	23	4
Brick House ...	34	4	...	...
Doorawarrah ...	37	3	...	...
Bintholya ...	...	...	...	...
Mungarra ...	22	1	...	...
Clifton Downs ...	...	...	...	..
Dairy Creek ...	20	2	...	...
Upper Clifton Downs	...	...	...	...
Dirk Hartog Island	...	...	...	...
Sharks Bay ...	117	6	18	3
Kararang ...	184	5	...	...
Meedo	47	2	...	...
Tamala	335	6	...	...
Wooramel ...	66	4	12	1
Hamelin Pool ...	76	5	57	6
Byro	30	1	...	...
Yarra Yarra ...	38	3	...	...
Berringarra ...	...	...	...	...
Mt. Gould ...	39	2	...	...
Moorarie ...	2	1	...	...
Wandary ...	14	1	...	...
Peak Hill ...	63	4	8	1
Mt. Fraser ...	...	...	...	...

Stations.	July. No. of points. 100 = 1in.	July. No. of wet days.	August. No. of points. 100 = 1in.	August. No. of wet days.
Gascoyne—*contd.*				
Abbotts	12	1	17	2
Belele	20	1	...	...
Mileura	21	1	...	...
Milly Milly ...	...	...	...	...
Manfred ...	78	3	...	...
New Forest ...	...	...	...	...
Woogorong ...	69	4	...	...
Boolardy ...	...	...	...	...
Twin Peaks ...	100	6	...	...
Billabalong ...	106	4	...	...
Wooleane ...	83	7	...	...
Woolgorong ...	136	7	...	...
Murgoo	76	7	49	4
Yallalonga ...	139	7	...	...
Meka	74	3	...	...
Mt. Wittenoom ...	69	6	...	...
Nannine	18	1	54	2
Star of the East...	15	1	60	3
Annean	55	2	...	...
Tuckanarrra ...	91	3	47	3
Coodardy ...	65	2	...	...
Cue	61	5	56	4
Day Dawn ...	72	5	51	4
Lake Austin ...	63	3	53	2
Lennonville ...	79	7	43	2
Mt. Magnet ...	83	7	39	2
Challa	104	5	60	2
Youeragabbie ...	89	4	...	...
Black Range ...	36	1	76	2
Murrum	43	4	73	1
Burnerbinmah ...	54	7	...	...
Barnong	223	9	...	...
Mellenbye ...	125	8	128	8
Yalgoo	131	6	64	3
Wagga Wagga ...	115	6	66	2
Gabyon	149	5	...	...
Tallyrang ...	194	7	...	...
Gullewa	193	6	...	...
Muralgarra ...	104	7	84	7
Wydgee	63	5	...	...
Wearagaminda...	...	...	66	7
Gullewa House ...	233	9	...	...
South-West Division (Northern Part):				
Murchison House	367	11	...	...
Mt. View ...	293	9	100	6

RAINFALL—*continued.*

Stations.	July. No. of points. 100 = 1in.	July. No. of wet days.	August. No. of points. 100 = 1in.	August. No. of wet days.
South-West (Northern)—*contd.*				
Mumby	356	2	303	11
Yuin	113	5	...	...
Northampton ...	564	10	383	12
Oakabella ...	...	...	...	...
Narra Tarra ...	...	...	...	...
Tibradden ...	399	13	262	12
Myaree	430	12	295	10
Sand Springs ...	373	7	...	...
Mullewa... ...	206	11	172	9
Kockatea ...	220	7	180	8
Bootenal ...	...	...	...	...
Geraldton ...	447	12	197	12
White Peak ...	289	8	...	...
Greenough ...	453	9	121	8
Bokara	383	16	163	12
Dongara ...	294	10	130	7
Brookman's Hills	272	7	...	...
Strawberry ...	467	13	294	11
Nangetty ...	276	11	...	...
Mingenew ...	363	13	253	11
Urella	350	8	...	...
Yandenooka ...	502	13	198	10
Rothesay ...	...	...	...	...
Ninghan... ...	117	6	63	4
Field's Find ...	81	7	37	3
Carnamah ...	350	10	149	8
Watheroo ...	377	12	165	11
Dandaragan ...	634	13	236	14
Moora	444	13	155	11
Yatheroo ...	684	13	...	...
Walebing ...	455	17	201	13
Round Hill ...	347	14	144	13
New Norcia ...	...	...	265	12
Wannamel ...	593	14	338	11
South-Western Division, Central (Coastal):				
Gingin	1068	14	526	12
Belvoir	876	15	494	11
Mundaring ...	936	14	552	11
Wandu	776	20	425	16
Guildford ...	777	17	382	11
Kalbyamba ...	558	17	457	10
Canning W't'r'w'ks	554	12	305	7

Stations.	July. No. of points. 100 = 1in.	July. No. of wet days.	August. No. of points. 100 = 1in.	August. No. of wet days.
South-West (Coastal)—*contd.*				
Perth Gardens ...	681	16	349	12
Perth Observatory	683	19	350	16
Subiaco	657	18	346	13
Claremont ...	624	15	310	9
Wanneroo ...	972	17	...	...
Jandakot ...	539	13	470	10
Fremantle ...	474	17	332	13
Rottnest... ...	504	16	...	...
Armadale ...	757	17	504	16
Rockingham ...	469	13	227	12
Jarrahdale (Norie)	828	17	134	13
Jarrahdale ...	943	17	590	15
Serpentine ...	679	17	397	17
Mandurah ...	886	16	468	12
Pinjarra (Blythewood)	708	19	364	13
Pinjarra	822	18	415	10
Yarloop	622	18	422	14
Harvey	692	15	354	15
Upper Murray ...	821	18	479	15
South-West, Central Part (Inland):				
Hatherley ...	294	8	...	...
Dowerin ...	299	10	...	...
Momberkine ...	415	9	308	8
Warramuggin ...	167	5	...	...
Newcastle ...	656	14	326	9
Emungin ...	299	12	...	...
Eumalga ...	687	14	325	10
Eadine	562	16	...	...
Northam ...	452	16	256	11
Grass Valley ...	453	11	180	7
Meckering ...	344	8	177	7
Cunderdin ...	329	9	126	7
Codg-Codgin ...	205	9	...	...
Yarragin ...	169	6	107	5
Doongin... ...	209	8	110	7
Cutenning ...	156	9	...	...
Cardonia ...	184	6	...	...
Sunset Hills ...	388	12	221	11
Jetcobine ...	481	13	...	...
Cobham	541	13	291	12
Yenelin	320	7	...	...
Mt. Caroline ...	224	9	139	7

RAINFALL—*continued.*

Stations.	July. No. of points. 100 = 1in.	July. No. of wet days.	August. No. of points. 100 = 1in.	August. No. of wet days.
SOUTH-WEST (Central)—*contd.*				
York	500	14	248	12
Dalebridge ...	456	11	253	7
Beverley ...	581	11	307	8
Bally Bally ...	387	13	299	10
Oakdale	415	14	253	10
Barrington ...	417	13	201	9
Qualin	266	6	253	6
Stock Hill ...	354	8	194	7
Sunning Hill ...	367	14	200	10
Brookton ...	339	9	194	9
Wandering ...	620	15	303	8
Glen Ern ...	436	17	210	11
Pingelly ...	375	11	177	5
Yornan	352	15	155	8
Marradong ...	631	15	346	10
Wardering ...	252	10	...	...
Bannister ...	620	15	...	...
Wounaminta ...	356	14	...	...
Narrogin ...	334	13	169	10
Narrogin State Farm	411	14	187	11
Wickepin ...	326	13	...	...
Gillimaning ...	271	13	...	...
Bunking ...	197	3	...	...
Bullock Hills ...	232	8	...	...
Bullingarra ...	...	...	...	...
SOUTH-WEST DIVISION (SOUTHERN PART):				
Bunbury ...	754	20	303	11
Brunswick ...	702	14	315	8
Collie	732	19	309	13
Glen Mervyn ...	743	13	224	10
Donnybrook ...	677	20	345	13
Boyanup ...	671	14	275	15
Ferndale ...	514	14	559	11
Busselton ...	559	22	234	6
Quindalup ...	691	21	368	18
Cape Naturaliste	641	23	315	19
Glen Lossie ...	649	22	403	19
Lower Blackwood	522	14	262	17
Karridale ...	694	26	389	25
Cape Leeuwin ...	662	25	319	21
Biddellia ...	709	14	...	...

Stations.	July. No. of points. 100 = 1in.	July. No. of wet days.	August. No. of points. 100 = 1in.	August. No. of wet days.
SOUTH-WEST—(Southern)—*cont.*				
The Warren ...	527	23	...	...
Lake Muir ...	415	18	...	...
The Peninsula ...	490	27	...	...
Mordalup ...	288	17	...	...
Deeside	461	21	365	18
Riverside ...	474	18	...	...
Balbarup ...	632	13	396	12
Wilgarup ...	558	22	...	...
Cundinup ...	288	13	...	...
Bridgetown ...	465	20	332	17
Westbourne ...	392	15	...	...
Hilton	426	10	...	...
Greenbushes ...	609	13	311	9
Greenfields ...	498	13	230	13
Glenorchy ...	370	9	...	...
Williams ...	324	10	221	9
Arthur	354	...	167	7
Rifle Downs ...	37	5	184	9
Darkan	414	10	...	...
Wagin	223	15	210	9
Glencove ...	288	11	165	10
Dyliabing ...	208	10	176	11
Katanning ...	311	10	156	12
Kojonup ...	435	15	241	11
Broomehill ...	266	8	138	12
Woolagannup ...	138	11	110	12
Sunnyside ...	303	12	159	15
Talbot House ...	504	14	...	...
Woodyarrup ...	270	11	137	10
Mianelup ...	167	12	104	10
Cranbrook ...	217	15	163	10
Toolbrunup ...	200	9	130	10
Tambellup ...	254	13	...	...
Blackwattle ...	222	11	...	...
Woogenellup ...	174	13	...	...
Mt. Barker ...	180	16	223	14
Kendenup ...	185	14	234	16
St. Werburgh's...	...	...	...	...
Forest Hill ...	327	20	326	18
Wilson's Inlet ...	371	19	...	...
Denmark ...	...	...	...	...
Grasmere ...	299	19	427	19
Albany	306	21	495	22
King River ...	193	11	455	15
Point King ...	314	14	454	18
Breaksea ...	292	24	362	23
Cape Riche ...	...	...	...	...
Cherilalup ...	235	7	...	...
Pallinup... ...	243	9	135	9

RAINFALL—*continued.*

Stations.	July. No. of points. 100 = 1in.	July. No. of wet days.	August. No. of points. 100 = 1in.	August. No. of wet days.
SOUTH-WEST—(Southern)—*cont.*				
Bremer Bay ...	131	8	160	12
Peppermint Grove	161	8	...	...
Jarramongup ...	...	...	...	...
Chillinup ...	125	77	...	...
EASTERN DIVISION:				
Dural	...	...	...	...
Wiluna	32	3	10	1
Gum Creek ...	Nil	...	Nil	...
Mt. Sir Samuel ...	31	2	5	1
Lawlers	74	6	62	4
Leinster G.M. ...	...	...	...	...
Darda	8	1	...	...
Lake Darlôt ...	...	...	...	...
Duketon ...	...	...	...	...
Salt Soak ...	15	2	...	...
Mt. Leonora ...	72	4	47	3
Mt. Malcolm ...	46	2	40	3
Mt. Morgans ...	35	2	15	1
Burtville ...	...	...	...	...
Laverton ...	37	3	13	2
Murrin Murrin ...	37	2	18	2
Yundamindera ...	93	3	40	3
Tampa	61	2	...	...
Kookynie ...	97	3	63	3
Niagara	90	2	57	3
Yerilla	95	3	...	...
Quandinnie ...	68	4	20	1
Edjudina ...	106	3	...	...
Menzies	128	4	18	2
Mulline	74	6	50	2
Waverley ...	...	...	...	...
Goongarrie ...	67	5	45	3
Mulwarrie ...	63	...	41	2
Bardoc	56	3	47	...
Broad Arrow ...	33	3	47	2
Kurnalpi ...	57	2	39	3
Bulong	37	4	79	4
Kanowna ...	48	4	35	4
Kalgoorlie ...	36	6	52	5
Coolgardie ...	29	5	54	4
Burbanks ...	53	2	90	4
Woolubar ...	15	2	...	...
Widgiemooltha ...	33	4	71	5
50-Mile Tank ...	29	4	38	3

Stations.	July. No. of points. 100 = 1in.	July. No. of wet days.	August. No. of points. 100 = 1in.	August. No. of wet days.
EASTERN—*contd.*				
Waterdale ...	54	4	193	5
Norseman ...	10	2	49	4
Lake View ...	28	3	...	...
Bulla Bulling ...	47	3	50	3
Boondi	67	6	61	4
Boorabbin ...	84	5	55	4
Koorarawalyee ...	77	10	73	2
Karalee	88	3	45	2
Yellowdine ...	80	3	...	...
Southern Cross ...	97	3	45	3
Parker's Range ...	104	10	...	...
Parker's Road ...	110	3	55	3
Mt. Jackson ...	59	5	...	...
Bodallin ...	113	6	...	...
Burracoppin ...	...	...	...	...
Baandee ...	111	5	158	7
Kellerberrin ...	201	10	119	10
Merredin ...	167	7	106	7
Nangeenan ...	157	6	108	5
Mangowine ...	183	8	84	6
Wattoning ...	220	3	...	...
Noongarin ...	172	7	81	5
EUCLA DIVISION:				
Ravensthorpe ...	77	9	140	11
Coconarup ...	80	5	...	...
Hopetoun ...	106	4	155	9
Fanny's Cove ...	...	...	...	...
Park Farm ...	192	10	...	...
Esperance ...	122	10	330	14
Gibson's Soak ...	147	9	...	...
30-Mile Condenser	100	7	...	...
Swan Lagoon ...	70	5	...	...
Grass Patch ...	...	...	...	...
Myrup	170	12	...	...
Lynburn ...	127	12	...	...
Boyatup	178	9	...	...
Middle Island ...	73	9	...	...
Point Malcolm ...	52	10	...	...
Israelite Bay ...	23	4	114	11
Balbinia	...	...	...	...
Frazer Range ...	29	3	...	...
Balladonia ...	9	3	37	4
Southern Hills ...	...	...	...	...
Eyre	35	5	49	7
Mundrabillia ...	...	...	...	...
Eucla	23	5	72	8

The Observatory, Perth,
5th September, 1905.

W. E. COOKE,
Government Astronomer.

By Authority: A. CURTIS, Acting Government Printer, Perth.

JOURNAL

OF THE

Department of Agriculture

OF

WESTERN AUSTRALIA.

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EDITOR'S NOTES.

Agricultural Students.—At the recent ploughing matches held at the Upper Chapman, two of the students from the Chapman Experimental Farm, J. Rorhs and C. Chatham, competed in the youths' class and succeeded in winning first and second prizes respectively. J. Rorhs also secured two special prizes.

Salt for Cattle.—If settlers and those keeping dairy cattle only knew the great advantage cattle derive by having free access to a lump of salt, they would see that a piece was always placed in such a position that the animals could lick it when inclined. Where salt is so kept, milking cows will go to it at least twice a day, proving that they like it.

Bacon Factory.—Mr. W. Hutton, proprietor of the well-known firm of J. C. Hutton, ham and bacon curer, intends to commence operations in this State. The establishment of such a factory here will materially assist the farmer in disposing of the by-product of his farm, besides enabling the consumer to obtain the goods at a reduction in price to that now demanded.

Free Distribution of the Journal.—In this issue will be found a form to be filled up by those entitled to make an application for a free copy. The *Journal* will be sent to all those getting their living off the land, such as squatters, graziers, farmers, settlers, fruitgrowers, and gardeners. In making application it must be stated that the applicant is getting his living off the land.

Lima Beans.—It is surprising that our market gardeners do not go in for the cultivation of lima beans. They are, without doubt, the nicest summer vegetable grown, stand any amount of dry weather, and the yield is very abundant. The dwarf kinds do not require any support, and can be sown from now up to December. They should be sown in drills 18 inches apart, and at least a foot apart in the drills.

Restricting Bee-keeping.—The beekeepers of a certain fruit-growing section of California got into an altercation about pasturage for their bees, and, as a result, bee-keeping was abolished in that part of the State. During the next few years the fruit crop fell off fully one half. The question was investigated by the alarmed growers, and it was found that the decrease in fruit had been coincident with the giving up of bee-keeping.

Cattle Tuberculosis.—We have received a copy of a work on cattle tuberculosis from the author, Mr. H. Sessions. It contains 120 pages of valuable reading matter, and treats the subject in a most exhaustive manner, in very simple language, so that the ordinary farmer or stock-breeder can readily understand it. The publishers are Messrs. Bailliere, Tindall & Cox, 8 Henrietta Street, London, and the price of the book is three shillings.

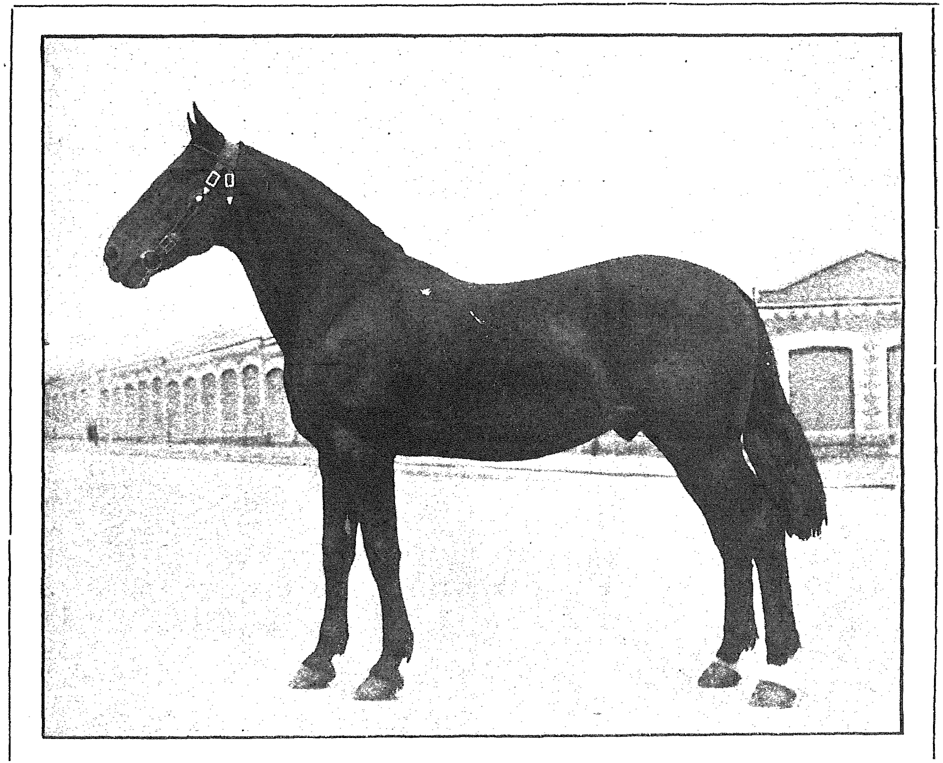
Wool Exports.—A return compiled by Messrs. Dalgety and Co. shows that the quantity of wool exported from Australia from 1st July to 31st August was 31,974 bales—an increase of 4,785 bales on the corresponding period of last year. The New Zealand exports for the same term showed a decrease of 584 bales—from 17,723 to 17,139. Queensland shows the largest increase—from 4,356 bales to 8,154 bales, or a gain of 87 per cent.

Belling Turkeys.—Turkey keeping, which is becoming very popular in this State, promises to be a most profitable undertaking. These birds, when provided with good runs, almost keep themselves, the only drawback being that they wander so far away. Turkey breeders in America have adopted a system of "belling" the gobbler; almost any light "tinkler" will answer. It also seems to assist in keeping a flock together. It is stated that after introducing a bell or two into a flock such a thing as a lost bird is unheard of.

Agriculture in South-West.—During a recent visit made in the South-West districts we were very much struck with the large areas of excellent land to be seen around the Busselton district. It may also be noticed, too, that considerable areas are held by some people content to cultivate only a few acres of their holdings, or run a few head of cattle. Such a condition of affairs is much to be regretted, and is manifestly unfair to the railways, for where £5 worth is being produced there ought to be £5,000 worth.

Famous Trotting Sire.—Mr. Noel M. Brazier, of Upper Capel, Donnybrook, has recently imported the well-known standard-bred trotting sire "General Tracy," an illustration of which appears in this issue. Mr. Brazier states "that 'General Tracey' is a sure foal-getter; he has a splendid constitution, while all his progeny are bays and browns." Those who are in want of the services of a good stallion should communicate with Mr. Brazier at once. It is gratifying to note that some of our breeders are alive to the fact that only the best horses pay.

Shropshire Rams for Crossing.—The extraordinary "catch on" which the breed has made in the Commonwealth must be attributed solely to the highly successful results of crossing with the Shropshire for the production of early fat lambs, and also to the early maturing qualities of the half-



"General Tracy"—Berlin (imported)—Jenny Tracy, 2·18 (imported).

bred Shropshire wether. The extensive use of the Shropshire ram has almost entirely revolutionised the sheep business in Australasia, the great majority of the farmers being now able to sell the bulk of their output as fat lambs, or, at the latest, as yearlings, as against the marketing of two, three, and even four-year-old sheep of former days.

WHEAT-GROWING IN SOUTH AUSTRALIA.—In a report on wheat-growing on the Murray flats in South Australia, published in the *Journal of Agriculture* of South Australia, some very startling statements are made. The result of five years' work, viz., from 1900 to 1904 inclusive, is given, showing anything but a good result. Two hundred acres were cropped, and the total profit for the whole period amounted to £20 18s. 1d.; even then a number of minor expenses were not taken into account. Compare this with the regular average of the crops in this State of eleven bushels to the acre, then we can easily understand the reason why so many South Australian farmers are settling down here.

STARTING A FLOCK.—In starting a flock only healthy, robust ewes should be selected, and all of them should be of the same type. They should be mated with a first-class ram of similar type, and one of the same breed as the ewe flock, unless the farmer is crossing for some special purpose and does not intend to retain the progeny for breeding. Each year the ewes should be carefully weeded out, only the best being retained. By following the system of culling closely, a high degree of uniformity will in a few years be established in the flock. Every farmer knows that the presence of a few culls in a lot of animals always proves an obstacle to a sale at a remunerative price; therefore great pains should be taken to have the flock of uniformly good quality.

ASSISTANCE TO AGRICULTURAL SOCIETIES AND SHOWS.—In accordance with a resolution passed by the Legislative Assembly on 16th August, on the motion of Mr. F. F. Wilson, M.L.A., the Premier laid upon the table of the House recently the following return:—(1) The approximate amount of money granted to agricultural societies holding shows throughout the State, from June 30, 1902, to June 30, 1905, was £7,566 16s. 2d.; (2) the amount of financial assistance granted by the Government for the erection of agricultural halls, from June 30, 1902, to June 30, 1905, was £3,539 12s. 11d.; (3) the approximate value of land granted by the Government for the erection of halls and show grounds, from June 30, 1902, to June 30, 1905, was £2,009 10s.

FOREST LANDS.—The following is a list of applications received by the Government for forest lands of this State:—W.A. Jarrah Sawmills, Ltd., about 14,000 acres; Collie Timber Co., about 7,000 acres; George Greenway, about 10,000 acres; J. M. Ferguson, about 4,000 acres; Sexton and Drysdale, area not stated; F. W. Steere, area not stated; J. H. Browne, area not stated; E. Brown and Co., area not stated; S. Dyke, area not stated; Whittaker Bros., 30,000 acres; F. D. Good, about 14,000 acres; J. A. Buckingham, 200,000 acres; T. R. Lynas, 15,000 acres; J. M. Ferguson, 40,000 acres; Summer and Lang, area not stated; Sexton and Drysdale, 2,000 acres; J. McDowell, area not stated; Adelaide Timber Co., 2,560 acres; E. A. and J. T. Buckingham, area not stated.

THE DAIRYING INDUSTRY.—Under "The Industrial Conciliation and Arbitration Act, 1902," the Coastal Dairymen's Employees' Union of Workers have applied to the Court for an amendment of the award delivered in September of last year with respect to the dispute then existing between the Union and the Coastal Districts Dairymen's Industrial Union of Employers. In that award 70 hours was fixed as a week's work. The workers now desire that this shall be altered to 65. And they ask, further, that, apart from Christmas Day, Boxing Day, New Year's Day, Good Friday, Easter Monday, Eight Hours Day, and all Sundays, each Wednesday shall be observed as a half-holiday from noon. The date of the hearing of the application has not yet been fixed.

AGRICULTURAL LECTURES.—In this issue will be found a *résumé* of the first seven lectures given in the lecture hall attached to the Department of Agriculture during the last month. The following are the subjects dealt with:—Sheep-breeding, Insect Pests in the Orchard, Fruit Culture, The Food of Plants, Bee Culture, Poultry-raising, and General Agriculture. The lectures were all well attended, and made interesting by a number of slides shown with the aid of a very fine lantern. While we cannot reproduce all the pictures, it is to be hoped that the subject-matter of the lectures published will prove both interesting and instructive to those readers who were unable to be present. The balance of the lectures will be published in our next issue.

ANALYSIS OF SOILS.—We are convinced that a comprehensive analysis of the soils of this State is necessary to the rapid development of the agricultural industry. With this end in view it is the intention of the Department to divide the several agricultural districts into zones, and classify the soils under their respective types as distinguished by geological origin and chemical composition. To the classification of each type will be attached all physical data, such as the rainfall, the average temperature, and the like. This will provide reliable and invaluable information for intending settlers, and even for those already on the land. Even now the Government is prepared to make free analyses of soils for *bonâ fide* farmers, and the larger work of systematically analysing the soils of the various districts will be entered upon without delay.

CO-OPERATIVE BEE-KEEPERS.—We have received a copy of the West Australian Bee-keepers' Co-operative Association's prospectus. Its object is to place the bee-keepers' interests on a sound commercial footing, and to see that all product is sold at a fair market value. The bee-keepers in this State are making every effort to establish their calling as one of the permanent industries of the State. It is pleasing to note that the first step towards success has been taken in forming themselves into a co-operation. The report of the annual conference contains much interesting matter, and deals with the initial steps taken towards the formation of the co-operation. The capital is fixed at £2,000, in 4,000 shares of 10s. each; 2s. 6d. per share on application and 2s. 6d. per share on allotment. The secretary, from whom all information can be obtained, is Mr. Walter K. Potter, jun., of Goldsworthy Road, Claremont. It is certainly a good move, as everyone keeping bees must, for their own protection, become shareholders. The movement is deserving of every success. The pages of the *Journal* will be always open

for the purpose of making public the doings of the Association and otherwise assisting them. It is to be hoped that in our next issue we will be able to announce that the whole of the shares have been applied for.

WATERING SHEEP.—There may be times in wet weather, or when heavy dews are falling, or when feeding on very succulent foods, that the watering of sheep is not absolutely necessary, but still it is wise and profitable to supply from one to six quarts of fresh water per head per day. In winter fattening experiments, lambs allowed constant access to fresh water gained over two pounds per head per month more than those who had not the same privileges, and the actual cost of production is at least a half-penny per pound less than that for lambs fed on the same food, but allowed water only once a day. The following instructions have been given to a correspondent who wrote asking for particulars as to the construction of dams for conserving water for sheep:—The maximum quantity of water required per sheep per day is one and a-half gallons. Hence if you have to water 300 sheep for say six months (180 days)—the period during which dry weather prevails in this country—the quantity of water required would be 81,000 gallons. To hold this quantity of water a space of 12,960 cubic feet would be required. This will serve you as a guide in the construction of your dam. If you intend to construct a weir across a gully for instance, you must take into consideration the water-holding capacity of the soil. Dams are sometimes made, and prove successful, by throwing almost any obstructions—such as timber, stones, etc.—across the gully, and then banking up and puddling with clay on the water side. This method would do in a locality not subject to floods. If floods are likely, a substantial dam would be required, and the best then would probably be a good over-shot dam. You must also take into consideration the question of evaporation, as the quantities mentioned above are about what would be actually required by the sheep. The amount of evaporation would depend entirely upon the area of the exposed surface and the heat to which it is subjected during the warmer weather. It is impossible, without further data, to say what this would be, but you should, I think, make allowance for an evaporation of not less than 50 per cent.

PEANUT CULTURE.—What should be a most profitable crop in this State is that of the peanut, or earth-nut. The cultivation is easy, and the yield, on suitable soil, enormous. Almost any quantity can be disposed of at from £75 to £110 per ton. They have been grown near Perth very successfully without a single drop of water being given them. A writer in the *Weekly Chronicle* thus describes the best way of cultivation:—"Prepare the ground well; have it good and mellow; then mark out in rows four feet apart, and unless the ground is very moist run a little water along the row, sufficient to soak it up nicely. After it dries a little, drop your nuts, one kernel in a place, 22 inches apart. I tried placing one, two, three, or four in a place, but found that the one had more and larger nuts than either of the others. After having dropped the nuts, cover with cultivator. Nothing more needs to be done until they get up nicely. About three weeks after they come up, mark on both sides with a shallow shovel marker—one that throws the dirt both ways. Mark just close enough so as not to cover up the young vines. Then irrigate until the ground is thoroughly soaked. After it is dry enough cultivate, throwing the dirt close to the vines. Continue this every three weeks during the season; each time mark a little

farther from the row, and always when cultivating roll the dirt close to the vines; by so doing you will keep the ground high and mellow, so, as the vine spreads, the little tender spurs that shoot down can penetrate it and bear fruit. Do not allow the water to run over the row, as it causes the ground to bake and the nuts to be a dark colour. It is not the nuts that require the moisture, but the tap-root of the vine underneath the nuts. Do not cover up the blossoms, as some people advocate; the blossom of the peanut ought not to be covered, either in this or any other country. I investigated the matter thoroughly during the season that has just closed. I selected six rows, side by side, each receiving the same amount of water and attention. Three of these rows I covered up the blossoms, as they made their appearance before sunrise in the morning, with a little moist dirt. When I harvested these six rows I found, to my satisfaction, that the three rows not covered had a third more nuts and considerably larger in size."

Tobacco Growing.—Several inquiries have been made of late as to the possibilities of tobacco growing in this State. There is no doubt that the leaf can be successfully grown in very many parts of Western Australia, even as far south as the Blackwood; it would be as well, however, to try a small quantity first as an experiment. At present there is practically no local market for the raw material; but still, if it could be grown and cured successfully, it could be exported, for there is always a good demand. Tobacco requires a comparatively short season for its growth and is sensitive to frost. The quality of the tobacco produced is greatly modified by the variations in soil and climate. The different types of tobacco are grown on soils varying in composition from coarse sandy land to heavy clay limestone. The heavy shipping tobaccoes are grown on soils containing a large proportion of clay, or which, for other reasons, are very retentive of moisture. Such tobaccoes cure to a dark brown or red. On lighter soils a more delicate leaf is produced, which cures to a bright red mahogany or yellow colour. The most essential fertilisers in the culture of tobacco are nitrogen, potash, and lime. A crop of 1,875lbs. of tobacco requires for its development about 140lbs. of potash, 100lbs. each of nitrogen and lime, and about 16lbs. of phosphoric acid. Potash is especially desirable, and the necessity for its use cannot be too strongly emphasised. Tobacco is grown from seed, which should be sown in a specially prepared seed-bed. Cleared new land is desirable for the seed-bed as being more free from weeds than old land. The seed-bed is usually burned over to clear any possible seeds of weeds, etc. This is done by piling brush on the land and firing it, letting it burn for about an hour in one place and then moving it on to another part of the bed. Seed should be sown at the rate of a tablespoonful to every 100 square yards. This will give enough young plants to plant out about seven acres. The seed is lightly rolled down or whipped in. When planting out, the land should be thoroughly well worked. The seed-bed should be well watered before removing the plants, as they are then less liable to injury. Topping is the breaking off of the bud at the top of the stalk. This is done when the button is well out. By this means the leaves grow much larger, ripen up more evenly, and their quality and appearance are much improved. All the plants should be topped uniformly at the same height. Priming consists in the removal of four or five of the bottom leaves. It is done at the same time as the topping. Soon after topping, sprouts or suckers put out from the axis of each leaf. These should be regularly broken off every week or ten days.

AGRICULTURAL POTENTIALITIES.

THE STATE AS A GRAIN PRODUCER.

AGRICULTURISTS AND ARTISANS.

THE NEED OF POPULATION.

"It is to the primary producer," said Mr. C. F. Chaplin, the Director of Agriculture, in giving evidence before the Federal Tariff Commission at Parliament House on Friday, "that our attention is first given, as it is from this source that all collateral industries spring. Western Australia, in an agricultural sense, is *sui generis* in comparison with the other States of the Commonwealth, as its geographical position gives it a closer proximity to the world's markets. The advantages of this is apparent when the production of cereals and other commodities of the soil gets beyond our local requirements, and compels us to seek a market abroad. We cannot expect to compete with such products grown in Western Australia in the other States, and it would thus appear that we have nothing to gain in increasing a tariff to such a degree as to warrant the manufacture of agricultural machinery and implements within the Commonwealth. But the eye of the economist passes over the lines drawn frequently by political controversies and selfish interests, and views the whole question from a national standpoint. It is the fostering of the Federal spirit, and the encouragement of profitable industry within the four corners of this great continent, rich in its extraordinary producing versatility, which will consolidate, so to speak, that nationhood which is to be the country's strength. These remarks are intended to apply to the agricultural industry, leaving the discussion of the great mining industry of the State to those who are more closely associated with it. The enormous areas of good agricultural land, and the incomparable climate of this country for the growth of all kinds of cereals, indicate that this State should become one of the greatest wheat-producers in the Commonwealth. The total area under wheat for grain last season was 166,027¾ acres, while 84,928¾ acres of wheat were cut for hay. There were also 40,727 acres under oats, either for grain or hay. Last year about 2,000 bushels of wheat, and flour to the value of £85,813, were imported. It is anticipated that the quantity of wheat grown this year will meet local demands, and then the wheat-growers of this State must look abroad for their markets. It must, however, be borne in mind that the bulk of the flour, viz., £76,044 worth, was imported from the other States of the Commonwealth. The country here was admirably adapted for the production of malting barley, or any kind of barley.

AGRICULTURISTS AND ARTISANS.

The main question to be observed at the present time in this State is that relating to the increase in the number of people to till the wide areas of fertile lands, and to manufacture the goods the tillers of the soil require. We send away thousands of pounds that could be retained here under a system of mutual protection between those who would engage in the work of the artisan and those pursuing the

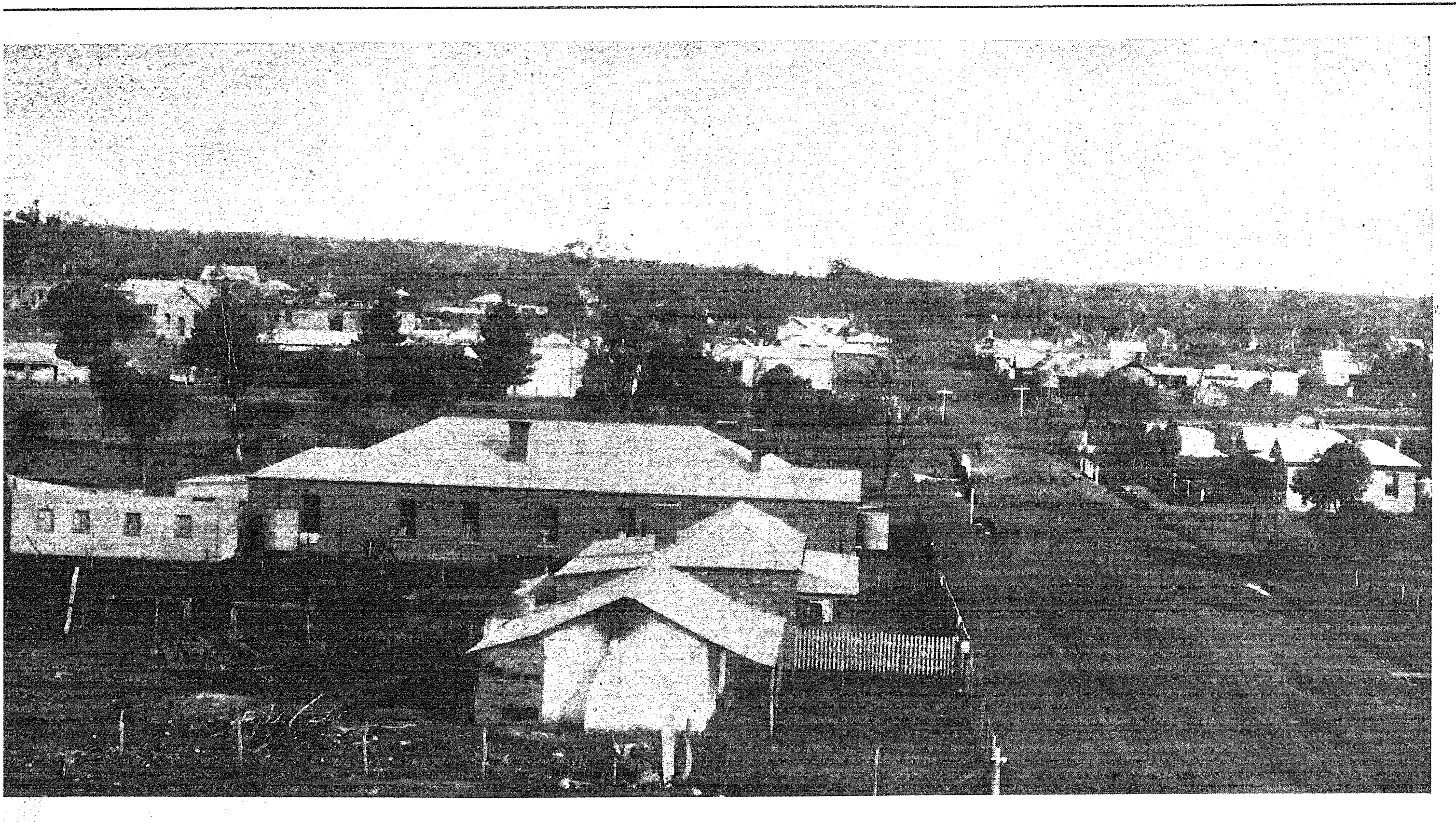
agrestic industries. We want to induce the artisan to remain here in profitable employment, and thus arrest the stream of capital which annually flows away to other parts of the world for the goods the primary producer requires. We want a balancing of production, so to speak. While the farmer is protected from the 'cheap manhood' of other countries, the artisan should be similarly protected. In Western Australia there is room for a large agricultural population, and we should make an effort to attract some of those from the densely-settled centres of Europe. It is an inequitable adjustment of the affairs of the world to permit the concentration of large bodies of people in certain portions of the earth, under adverse conditions, when such producing opportunities exist in Australia. The products of the soil in this country are within the reach of the millions possessed of the necessary willingness, bone, and muscle. Our thousands upon thousands of untilled acres of cultivatable lands, watered by the moisture-laden clouds that come from the Indian Ocean with unfailing regularity, are a reproach for our apathy and disregard for Nature's bequests. Hand in hand with the husbandman the artisan should go. If we encourage the farmer with cheap land and facility of access to markets, we must, in another way, encourage the manufacturer. The more people we can engage in trade, the more consumers for the farmers' produce we establish, and, as a means to this end, the farmer should not object to the payment of a duty on the machinery and implements required for his work. In so far as Western Australia is concerned, it may be argued that, in the event of a high protective tariff, the old-established manufacturing centres, such as Victoria, would be too strong as competitors with us here, but, with the same facilities for manufacture as regards up-to-date machinery and appliances, this State should be amply protected by its commercial isolation, so to speak, and attendant cost of freight. Raw material for manufacturing purposes should be landed here as cheaply as, or cheaper than, it could in the Eastern States. We want to encourage, or perhaps coerce, the manufacturers who now serve us from abroad to establish their factories here, and thus add to our population a reliable and prosperous artisan class."

TROPICAL PRODUCTS.

SUGAR, COTTON, FIBRES, AND RUBBER.

Possibilities of Local Production.

Western Australia, with its immense territory, embracing, in a manner of speaking, two extremes of latitude, provides a field for the exploitation of any industry which pertains to the soil. Its southern extremity is admirably adapted to the production of commodities which find congenial habitat in the temperate zone, while towards the northward, crossing many degrees of latitude, the products inseparable from the tropics can successfully be raised. There are many articles which the Commonwealth



NARROGIN.

now imports largely that could be grown in this State. Many of the articles we require, and now import from abroad, are staple products in other countries, and there seems no valid reason why a large number of these cannot be produced in the tropics of the Commonwealth, of which Western Australia forms no mean part. These commodities which call for special attention in this regard are cotton, cocoa, fibres, sugar, tea, rubber, coffee, and many others of more or less commercial value.

The Sugar Industry.

On being examined by the Chairman of the Commission (Sir John Quick), witness stated that there were people who were anxious to embark in sugar-growing in Western Australia. He had received a communication from a German firm, asking if they could secure 40,000 or 50,000 acres of land for the purpose of growing beets for sugar. The Agricultural Department had been asked by a representative of that firm to carry out certain experiments in connection with the production of beets, and witness understood that the firm would be prepared to invest capital from £150,000 to £400,000 in the enterprise. Mr. Chaplin said he believed beets could be produced locally in great quantities, and perhaps they could get two crops a year. The saccharine qualities of local beets had not yet been tested. Sugar beets containing the highest percentage of sugar thrived best in heavy, well-drained, and fertile clay loams. On the light sandy soils beets would mature earlier, but the yield of both beets and sugar per acre would be less than in heavier soils. Sugar beets on muck soils had generally given good yields, but the amount of sugar in the juice had been so low as to make their culture on such soils unprofitable. Hard clay soils should never be selected. Sugar beets grown in soils containing incrustations of soluble salts half an inch thick had shown good sugar contents. The cost of erecting a factory in America, with a capacity of 300 tons per day, was about £50,000. Potash and phosphoric acid were most essential as fertilisers for beets. Nitrogenous manures made large beets, but low in sugar contents, and excessive irrigation had the same effect.

Cotton Production.

The production of this commodity should earnestly command the support of the various departments in those States adapted to its growth. In many parts of Western Australia cotton grows well, and, considering this, and the great demand for this valuable product, the ramifications of such an industry can be limited only by the ability of the authorities to foster and encourage it. The raising of raw cotton in sufficient quantities for export should be an incentive for the manufacture of cotton goods in the Commonwealth, and thus supply all the local requirements with this class of material. The Federal import duty on manufactured cotton goods is at present 15 per cent., and on piece goods 5 per cent. When we can produce enough of the raw material that duty could very well be increased to 25 per cent., with a view of promulgating local cotton factories.

Examined by Mr. Wamsley, Mr. Chaplin said cotton could be produced as cheaply in Australia as in, say, India. The question of labour would come in in the matter of picking, but with modern machinery he was of opinion that the product could be turned out as cheaply here as anywhere else. His idea was to get the farmers of the State to experiment with about ten acres each. The better facilities for growing cotton would help local

growers. He thought cotton could be produced here and sold in the markets of the world at about 6d. per lb. Queensland farmers had expressed a desire to grow cotton if they could get 2d. per lb. for it without it being ginned. He could not see any advantage of putting a duty on the raw material. A bounty by the State might be a surer way of encouraging the production of raw cotton.

By Mr. Clarke: From what he had heard, cotton had been produced and exported from near Geraldton thirty years ago. Experiments had been made in cotton-growing, and they had been highly successful. The districts in which it could be grown were all well situated near to the seaboard. He was satisfied that there should be a good future for the industry in this State.

Fibres.

The import duty on binder twine into the Commonwealth is 5s. per cwt., and the duty on other twine is 20 per cent. *ad valorem*. The duty on binder twine should be increased to give an incentive towards the raising of the fibre within Australia. Speaking for Western Australia, it may be said that there are large tracts here suitable to the production of all the fibres. All the ropes and cordage manufactured in the Commonwealth are from imported fibres. Sisal hemp, another valuable fibre belonging to the family of the Aloe, would do well in many parts of this State, and in this we have a most valuable material for the manufacture of twine and other cordage. Among the other fibres of value are Mauritius, Manilla, Ramie, and Kitool. Of these the Manilla, being a species of the banana (Musa), is particularly adapted to the tropics or semi-tropics. Kitool is also a useful commodity produced from the palm *Arenga saccharifera*. It is used for making scrubbing brushes or brooms, and has remarkable power in resisting the action of water. These industries are worthy of every encouragement in the Commonwealth, especially in view of the large amount of money sent away to foreign countries for the raw material for ropes and twine of every description.

Rubber and Rubber Trees.

Modern invention has called very largely into requisition the product of the rubber tree. There are many kinds of rubber which experience has shown can be produced in the tropical areas of the Commonwealth. Probably the most valuable of these is the *Hevea Braziliensis*. In fact, it is held to be the best rubber known. The lack of incentive in the cultivation of the tree is probably due to the length of time it takes to come to full maturity, viz., ten years. It is capable of being profitable, however, before that time. Other rubber trees come into bearing when between two and three years old. The import duty on rubber goods at the present time is 10 and 15 per cent. When it is shown that the raw material can be produced here an assurance should be given to those contemplating starting this industry that a higher protective duty would ensue. Rubber growing is assuming large proportions in some parts of the world, and there is no reason why Australia should not come to the front in this when our climate and environment have provided for it.

To the Chairman: Mr. Chaplin said in some of the Northern areas of this State the conditions seemed to be very similar to those of North Queensland,

where the rubber tree grew well. A large plantation of good rubber trees would be as valuable to the State as a good gold mine.

In answer to Mr. Wamsley, witness said an increase to 20 per cent. or 25 per cent. on rubber goods would be sufficient to encourage the industry in the State, and he would also like to see an increase of 10 per cent. in the duty on the raw material.

AGRICULTURAL LECTURES.

SHEEP-BREEDING.

By R. E. Weir, M.R.C.V.S.

The first of the series of lectures now being delivered in the lecture room of the Department of Agriculture was given by Mr. R. E. Weir, M.R.C.V.S., on sheep-breeding.

Sheep, said Mr. Weir, belong to the order of ruminants, *i.e.*, like the ox, their digestive organisation is so constructed that they are enabled, during their periods of resting from cropping, to return the partially digested food from the stomach to the mouth for the purpose of its being further masticated. Chiefly owing to the compact formation of the teeth in the lower jaw, and the hard palate of the upper, sheep are enabled to crop close to the ground, and thus can thrive on very sparse pastures where cattle would practically starve. Close cropping, and the manner in which the blades of grass are partly cut and partly torn when the animal is grazing, accounts for the fact that stocking a country with sheep improves the pasture, and where possibly, in the first place, only one sheep to, say, four or five acres could be conveniently kept, a few years later twice that quantity, and frequently even greater numbers, may be grazed under the same favourable conditions. Sheep-raising is undoubtedly not only a very profitable, but also one of the most interesting studies that mankind experiences when stock-raising is undertaken as an occupation. It is profitable for the reason that an annual clip of wool is secured from the animal, from which is manufactured all manner of fabrics for our use; the flesh is also the most delicious of meats, and from the carcase alone a very profitable return is obtained. It is interesting from the fact that so much can be acquired by way of improvement in breeding; and the pleasure derived in this way must be a consolation to the experimentalist for the many years of patient toil which must needs be devoted to the security of the expected improvement. The greatest novice may make sheep-breeding a success, but careful management is at all times necessary to bring about the best results.

Needless to state, one of the chief factors to be guarded against is over-stocking. This is necessary not only as regards the conditions prevailing in our own State, but also throughout the whole of Australia. Years of plenty are usually followed by droughty seasons, and unless the

husbandman does not carefully reduce his stock in commensuration with the changed conditions, the result will be very serious pecuniary loss and, probably, ultimate failure. This has been forcibly exemplified time and again, particularly in the State of New South Wales, when in times of drought a vast amount of arid country exists which becomes almost useless for carrying stock under unfavourable conditions. It is well, therefore, to make provision, not only by reserving paddocks, but by conserving feed and water during good seasons for the less propitious one which may follow, as by such a system the stock-owner will be somewhat secured against losses from fire, drought, or flood, and the usual cheeriness of the successful farmer will, in consequence, not have suffered on account of the anxiety that neglect in this direction will assuredly bring about. Where sheep are kept in small holdings a change of pasture is frequently necessary, and during the winter months a dry camping ground is absolutely essential.

In-breeding should be avoided as much as possible, as in my opinion, nothing tends to deteriorate a flock more than the false economy that many practice in this respect. In all flocks a thorough weeding out should be resorted to at least once a year. The animals with broken mouths, or weakly constitutions, also those effete in the matter of lambing, should be fattened off and could be sold at the best marketable value. Well selected rams from other flocks of robust constitutions and fully matured should be purchased at intervals for mating purposes. The animal's pedigree should always be a consideration when making a choice, as only by this means can any certainty be arrived at as regards the progeny which is likely to follow.

The Merino is the most common breed throughout Australia, and no more prolific or suitable sheep could possibly be secured for the greater proportion of our pastoral country. It is inured to all sorts of climatic conditions and will subsist on the sparsest of herbage, and is in reality a proof of the survival of the fittest by existing in many parts where others starve. Having been imported into New South Wales early in the past century, they have since multiplied with such rapidity that their enormous increase, especially in that particular part of the Commonwealth, can only be considered in the light of a phenomenon. They are prized for their fine texture of wool (the fibre being of a tough silky nature, and specially suitable for the manufacture of the finest fabrics). The carcase, although small, is not usually overburdened with fat, the flesh being lean, sweet, and very palatable. Merinos readily cross with other classes, but this should be carefully avoided amongst new breeds, and only when an increased carcase for marketable purposes is desired should this be resorted to. Besides the Spanish Merino, which was originally imported into Australia, an American stamp known as the Vermont, and a French, viz., the Rambouillet, have recently come into prominence. The former is noted for an increased capacity for the production of wool from the characteristic folds of skin on the neck, and the latter for a smoother skin but longer wool and larger carcase.

Lincolns.—This class of sheep known as the "long wools," is very much used in Australia for crossing purposes, and very reliable results have been obtained from mating with the Merino. The majority of what are known as the "Half-breeds" and "Come-backs" are crosses of this class of sheep, proving additionally serviceable as butchers' mutton. The pure-bred Lincolns frequently weigh from 90 to 100lbs. The wool staple is of great length, of bright and silky hue, though of coarse texture.

Leicester.—The Leicester is one of the oldest breeds of England. It has been a remarkable sheep in the past, but is not so much in evidence in Great Britain to-day. Like the Lincoln, however, this class of sheep is very much used in Australia for crossing with the Merino with beneficial results. He, as you see, is a beautifully modelled sheep, with a different type of fleece to the Lincoln. Not so broad in the staple, more curly, and lustrous.

Romney Marsh.—Like other parts of the world, Australia requires a certain class of sheep for special grades of country. Thus, in certain wet and exposed parts of Victoria this breed has been found particularly suitable, but the results by crossing have not proved advantageous, as the same degree of hardiness cannot be maintained. They do not mature so early as the Leicester, but the clip of wool is usually greater and better.

Shropshire.—This is one of the most improved breeds of Great Britain at the present time. The Shropshire may be described as a most compact animal, short of leg, and practically woolled all over and under. The quality of its mutton has made it a prime favourite for crossing, but care must always be exercised in choosing well-developed and shapely ewes for mating, otherwise difficulty in lambing will result owing to the square proportions characteristic of the lamb.

Southdown.—This is the premier mutton sheep of England. It is distinctly not a large breed, but is extremely thick-set, compact, and neatly turned. The great breadth of back indicates a well sprung rib, and therefore sound constitution is a feature of the breed. This class of sheep has also proved invaluable for crossing.

Cheviot.—This is a very hardy class of animal, and was at one time very much in request on account of the wool; also as a mutton producer it has made itself known everywhere. Crossed with the Border-Leicester, the famous half-breds are produced.

Dorset Horn.—This class of sheep is known for its wonderful procreative powers, and can produce two crops of lambs in one year. It is largely used for breeding lambs for the early market. The Dorset Horn is a neat, symmetrical sheep and has become very popular, particularly in the South of England.

Western Australia is rapidly forging ahead in sheep husbandry. The Nor'-West of the State is very suitable for sheep-raising, the country in that particular part being well watered, and the indigenous grasses are of a most nourishing and easily digestible nature. Droughts are not so common as in many other parts of Australia, and the settlers have taken every precaution to conserve water and fence their runs into numerous paddocks for the purpose of insuring feed. The Kimberleys, however, are more suitable for the cultivation of cattle owing to the coarser nature of the food supply, although a portion of West Kimberley has been stocked with sheep in parts where the grasses are of a lighter and more easily digestible nature, but even in these parts cattle would thrive better. I look upon the country running from Northam to Albany as being especially suitable for early lamb production, and the day should not be far distant when that approximate acreage of 7,000,000 will be fully stocked up and producing lambs, not only, as at present, for our own demands, but for export purposes, and every effort should be made by the present Government for the erection of chilling works to provide for a trade which is rapidly approaching. Owing to the large importation of specially well-bred Merino rams, the standard of wool pro-

duced in this State now ranks amongst the highest. I might here state that one of our large breeders (Mr. J. F. Hassell, of Kendenup, near Albany) at the last Paris Exhibition secured the Grand Prix in the class for the exhibition of 25 Merino fleeces, and the all-round prices realised for West Australian wool has for the last few years demonstrated the fact that the quality compares favourably with the other States of the Commonwealth. A few interesting figures might be quoted as regards the entire production of wool throughout the States. Approximately 55,371,220lbs. were produced in 1903, and estimating this at 10d. per lb., it will be found that a revenue is secured from this source of over 12½ millions sterling. Of this quantity Western Australia produces 13,306,100lbs., from which a revenue of over £550,000 is derived, and, considering the comparatively few years during which the industry has been prosecuted, it augurs well for our future as a wool-producing country.

INSECT PESTS IN WEST AUSTRALIAN ORCHARDS AND VINEYARDS.

SECOND LECTURE.

By Fredk. Lowe, Government Assistant Entomologist.

Introduction.

"Nature made the Fruit Fly and Codlin Moth with appetites for fruit; Australians would have made them with appetites for sand."—Pudd'n Head Wilson's New Calendar—Revised.

Before proceeding with the detail work of actual description of the insect pests, the manner, extent, and effect of their depredations, and the procedure for combating them, a few words may not be out of place on the climatic and other conditions; the procurement, breeding, and distribution of insect pest-killing insects; the effect of insect pests on the fruit trade, and one or two other matters which may have only an indirect bearing, according to your particular standpoint, on the question now about to be discussed.

It is perhaps hardly necessary to state that my subsequent remarks are restricted to the consideration of orchard insect pests found in the fruit belt of the South-Western Division of the State, that is to say, the area contained within an imaginary line drawn from the mouth of the Murchison River in the North to Esperance in the South, and the South-Eastern coastal line. Over this tract of country, roughly, equal in size to that of the whole of Britain, visits have been paid to representative orchards. My thanks are due to the orchardists who extended to me the Western Australian welcome, and imparted much valuable information; also to Mr. Alex. Crawford, who gave me facilities for gaining a knowledge of the lay of the land and local conditions he knew would be so helpful for success in the work of my office.

Climatic and other Conditions.

"The Sparrow, introduced as an Insect Destroyer, swarms in millions and prefers corn and fruit to grubs."—(South Australia.)

The mild and equable climate; the unfailing regularity of the seasons; the protracted hot and dry summer; the absence of heavy sleet or snow

storms, and the luxuriance of vegetation, collectively combine to make the State of Western Australia an ideal country for the existence, propagation, and migration of all kinds and conditions of insect life.

Neither the heavy dews nor light night ground frosts, invariably dispersed before 10 a.m., appear inimical to the life of insects which attack our vines or fruit trees.

Throughout the winter, or rather the wet months of the year—it is really neither cold nor bitter enough to class as winter—heavy gales are frequent, with occasional sudden and short, yet severe, hailstone storms. However, these do not affect animal life, as insects, along with other creatures, herald their approach by taking to cover.

Further, the fact must not be overlooked that this vast area presents no impassable natural barriers, as snow-capped mountain ranges, large inland seas or deserts, to arbitrarily check the spread of an imported insect. Consequently, should a species from a temperate or sub-temperate climate, introduced at the port of Albany into the South-Western Division of the State, gain a foothold, it would be free to range northward or north-westwards in search of its food, as it became acclimatised. While a species entering at Fremantle, the chief port, would probably strike out either to Jandakot or along the banks of the Swan to the ranges; direction again being governed simply by the available food supply. At Geraldton, the northern port for this area, most favourable climatic conditions prevail for the introduction and spread of insects from other climes. It is extremely doubtful whether any imported insect pest would be confined locally within this stretch of territory to other than food areas.

A fortune awaits the inventor of an insect-proof fence, as, anyhow, growers have to fence in their orchards, and a fence, at a reasonable charge, that could keep insects out, would be just the thing. Bees and like beneficial insects could be kept inside the fence.

The paucity in number of species and individuals (excepting "Silver-eyes") of insect-feeding birds in Western Australia, especially in the fruit-growing area, by comparison with those found in other fruit-growing countries, adds another favourable factor to the rapid increase in individuals of introduced species of insect friends and foes.

It is a moot point whether non-migratory native insectivorous birds, breeding and feeding in certain districts, are as useful in keeping down the numbers of insects as migratory species which work through a country and eat all of their special brand of insects they can find.

Often the native birds turn their attention to insects for food only when other food supplies fail, as is well instanced in the case of the notorious "Silver-eye" and the fat years of red gum blossom.

This class of bird undoubtedly closely follows its insect food, for I am informed the Straw-necked Ibis did not make its appearance in these parts until after the swarms of grasshoppers came. It would be a simple matter to introduce any number of insectivorous birds if Australia, after her experience of imported birds and beasts, would entertain the proposition.

Numerous species of Sundews, insectivorous plants belonging to the family *Droseraceæ* and others not yet identified—some arranged to entrap

low-flying insects, others, those that crawl or happen to be attracted to alight on them—are to be seen in the bush, and these doubtless account for the destruction of many insects, though no practical use has as yet been made of them.

The presence of evergreen trees in the native flora provides comfortable shelter for insects during the boisterous months of the year. Insects usually retire beneath the loose bark, or in hollow trees and similar hiding places for partial hibernation. In short spells of very bad weather, orange trees may frequently be seen crowded with resting insects, which, to escape the fury of the elements, cling to the under surface of the leaves or twigs away from the weather side of the tree. A hurried observer would report them vanished, but the wily insects leave their cover to renew their work as soon as the weather clears.

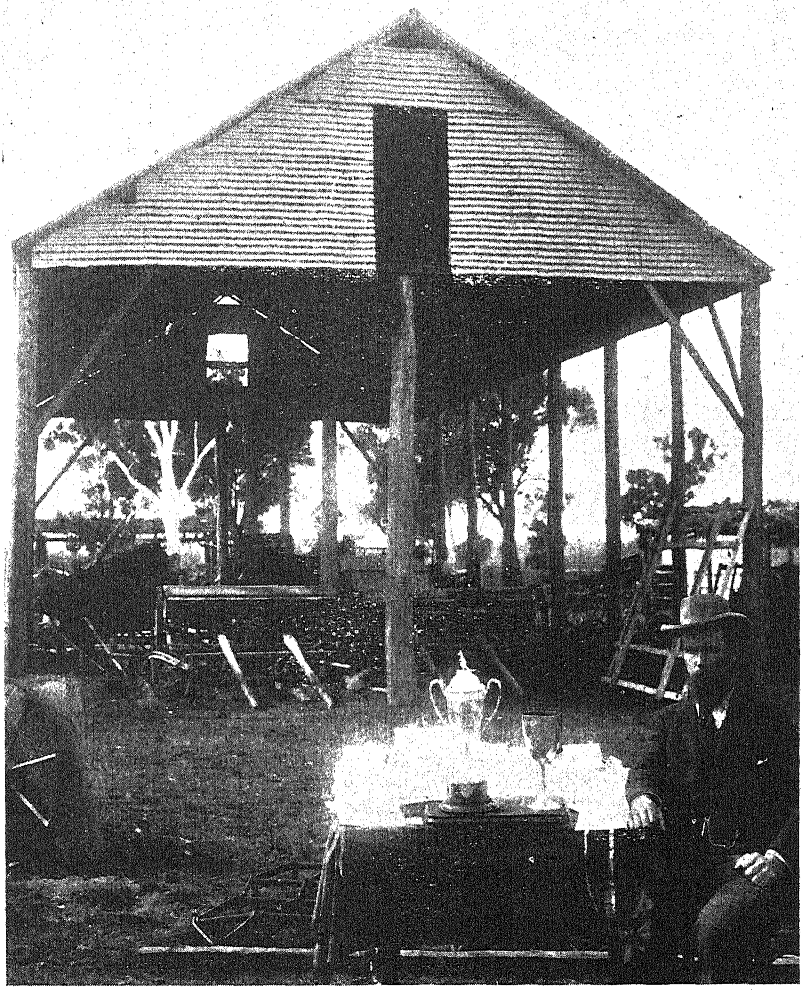
Fungi parasitic upon insects and the obscure epidemics which seem to rage periodically through a district or country, and are put down to bacteria or unknown causes, operate to keep down the numbers of a species of insect when conditions in nature are favourable for its increase and but few insectivorous animals or plants are present. As Professor Bottomley remarked, "there is much yet to learn on the phases of nature governed by bacteria, and there may be many things which we cannot explain now that careful research will reveal and simplify."

Climatic checks are the most extensive and arbitrary in their action, and must be considered when dealing with the artificial conditions that follow our inroads into and interference with the natural ones.

Through the constant and rapid intercourse between distant places, a perfectly harmless insect, owing to climatic checks, may be brought accidentally or intentionally from its native home beyond the seas, and, increasing abnormally, become a very harmful one in its new home in the southern continent.

In the event of an injurious immigrant insect landing on these hospitable shores, that had left behind its natural checks—climatic, parasitic, or otherwise—it is easily seen that the favourable conditions above mentioned may be calculated to stimulate and aid it to multiply to an enormous degree, unless active steps were taken by man to arrest its progress, or it met with a powerful native animal check as the six-spotted ladybird (*Orcus Australasiæ*) proves itself on the red scale; or, as unfortunately, the silver-eye bird has turned out to be for the introduced aphidivorous ladybird (*Leis conformis*), which in turn has taken a violent liking or disliking to the woolly aphis, an imported insect. To a lesser degree the curious Thalpocharis moth has turned its attention to the "Black Scale," it eats the soft-bodied insects and fastens their shucks together to form a cover for itself.

As shown in the case of a general fruit feeder, like the ubiquitous fruit fly, any insect pest under these conditions, providing always food is abundantly present, well might, once it secured a footing and had adapted itself to the alien conditions, habitat, and environment, and, according to the nature of the insect, or amount of outside assistance rendered, quickly or gradually overrun the State from end to end, and so threaten ultimately to demolish the whole industry of fruit-growing and thus rob industrial settlers of well-earned reward, for long and arduous labour.



PRIZES WON OFF "ROSEDALE" ESTATE.

Messrs. Clayton and Rintoul selected this land five years ago. To-day it is one of the most highly improved properties at Narrogin.

Importation of Insect-feeding Insects.

"To clear a small tree by placing on it several larvæ of *Coccinella* or aphidivorous flies collected from less valuable plants."

The importation into this State from other parts of the world of species of insects that destroy other kinds of insects, and are known as parasites, with the sole object in view of their assisting growers to contend against the destructiveness of harmful insects, called pests, in their orchards, is a subject that arrests the attention of every enlightened citizen of the State. For are we not all, either directly or indirectly, interested in the welfare and development of our fruit-growing industry and, consequently, in every real endeavour that is made to foster and raise it to the proud position it aspires to, of the first and best fruit producer of the States in the Australian Commonwealth?

The whole scheme of opposing insects that attack cultivated vegetation by their insect enemies, which assist to hold them in check on uncultivated vegetation, is founded on a philosophical statement made after a calm, contemplative view of nature's method. This statement—"no insect is a pest in a country where it is indigenous"—is proved only in relation to time and to things in nature. It was made years ago, before its present advocates were born, and gives an excellent illustration of the survival of the fittest, the war of species, which has raged and will continue to do so while things exist.

In some aspects of wild mother nature, that an insect is kept in place as one of many, is shown to be partly due to other insects that prey upon it.

There are many difficulties in the way to prevent our successfully applying the method under the artificial conditions we have set up. The theory appeals to, and now it is brought forward afresh, and worked for all it is worth by, the Department of Agriculture; there is no telling where it may had.

In 1799, three species of *Ichneumon* flies were named and recorded as parasitical on what is still a well-known insect pest to-day.

It would be as well to keep in the forefront of our minds the fact bearing directly on the subject under discussion, that the chief injurious insects, Woolly Aphis, Fruit Fly, Codlin Moth, San José Scale, and the majority of the others attacking fruit trees, though cosmopolitan and almost universally distributed in the countries, are not aboriginal to the continent of Australia. They were not volunteer immigrants, but transported, willy nilly, on the fruit trees or amongst their packing, and in the fruit itself, etc., before the passing of the Insect Pests Act. They feed on transported food, in very few instances deserting their ordinary food plants for the native flora, and have always been injurious under artificial conditions unless kept down by artificial means. The Black Scale presents a notable exception to this general rule, as it is to be found feeding on the native bush; but it is not known whether it is able to reproduce itself in that situation. While this paper is on proof, specimens on Zamia have come to hand from Wanneroo, and investigations are commenced to answer this momentous query. We must ever be faced with the grave danger of an indigenous insect leaving its native host plant to attack an imported plant.

As harmless and harmful insects are deported, in nearly every instance, in the first or second immature stages of their lives *in situ* on their food plants, it sometimes happens that the friendly insects which perform their

share of nature's work in keeping them in their place on their native heath, are not brought away with them, with the result that an insect landed without the natural parasitic insect checks in congenial surroundings soon multiplies and spreads until it becomes a more serious pest than it is considered to be in the country it is taken from. Nowadays, owing to the determination shown by the officers in charge to enforce our strict quarantine laws, framed for the restriction of the influx of the many common insect pests not yet domiciled here, these alien parasitic or predaceous insects are also prevented from entering; as the process of disinfection of all imported trees and diseased fruit adopted is warranted to kill all insects good or bad, they have scarcely any chance of following their natural prey. Special effort on our part remains the only way by which we can hope to obtain these friendly insect parasites, and we should be able to secure better work and much larger results from them if we can manage to free the primary parasites of their secondary forms before turning them loose on the field of action; then, as the primary forms have no foes to keep them down in turn, the idea is that they will quickly multiply and predominate over the insect pest.

Pest-killing insects should yield a most remunerative return for the capital outlay involved in their procurement from their native haunts in foreign lands; maintenance on the overland and sea voyages; breeding, and distribution throughout the State. They should soon repay illimitably the total disbursements, through the many and lasting—simply because they are natural—economic advantages derived from their introduction and establishment.

A strong colony should prove themselves capable of doing the work in one year, without orders, supervision, or wages that had previously kept a man engaged for the spraying season. He would be able instead to give his time to another part of the orchard work.

To grasp the full significance of the benefits the utilisation of these natural checks would confer, we should consider not only the large direct loss from the depredations of the insect, but, also, the annual cost growers had formerly been put to of combating insect pests by the use of spray-pump and kerosene. Again, the worry of carrying out tiresome time-wasting directions for spraying. A strong argument in favour of the attempt to adopt this rational method of treatment is the cost of the elaborate plant required for spraying and keeping it in repair.

Every one of the beneficial insects which prey on the harmful kind of insects, should it become firmly established in either of the States concerned, promises to turn out a valuable asset and add largely to its rural wealth in an unobtrusive manner. This would not be apparent, perhaps, to casual observers, though evident enough to those who know precisely when and where to look for the parasites, and, when seen, to estimate correctly the value of their work.

In the distant future these States, and particularly orchardists interested, will wake up to the fact that the number of the individuals of these imported species of beneficial insects have increased and spread far and wide, and overcome the insect pest in the bush as well as the orchard. We shall benefit increasingly by their introduction into the State, and they should eventually become a valuable accessory in fixing the prosperity and stability of the fruit-growing industries. The stagnation or development of which remains, where it has always been, in the hands of intelligent and

go-ahead growers who follow promptly and faithfully the advice of the fruit culture experts, and keep in touch with their discoveries.

It seems about to dawn on some of the fruit growers in the Eastern States that an attempt to apply such a method of ridding orchards of injurious insects is being actively made and is in successful operation. It may be they will find the particulars herein of interest to them. There should be no more difficulty in taking parasites from Western to Eastern Australia, than from Perth to Albany.

No want of faith in the efficacy of parasites as a means of combating fruit insect pests should prevent an extended trial, under a capable entomologist's supervision, to test their power for good or bad.

(To be continued).

FRUIT CULTURE.

THIRD LECTURE.

By A. Despeissis.

Mr. Despeissis, the horticultural and viticultural expert of the Department of Agriculture, delivered a lecture on "Fruit Culture." He said that up-to-date fruit-growing, like up-to-date farming, to be successful, must be conducted with system and a certain amount of technical knowledge. How many who ate an apple or a peach realised the amount of care and attention and scientific knowledge that had been displayed and brought to bear, knowingly or unknowingly, on the production of the fruit? It was true that a great many, without any trouble, could show from their gardens fruit quite as fine as others raised on carefully tended and systematically and scientifically treated trees, but they were unaware to what extent they had been helping nature, and were they to grow trees under less favourable conditions they would be less successful. It could be accepted as a fact that the careful grower who made up his mind to study every detail of his business was generally the most successful. There were some people who imagined that the pursuit of

Fruit-growing was a Pastime

and a pleasant hobby, and that all the grower had to do was to run a plough on his land and sit on a scarifier while the implement was scratching the weeds from the surface of the earth. Then they supposed the grower waited until the fruit was ripe; occasionally going round the orchard with a gun, while the fruit was ripening, to scare birds; finally shaking the fruit off the trees. According to that view the orchardist next ran the fruit into any kind of cases, the small and bruised ones in the centre, and over them some specially fine fruit, the cases being then rushed to market, then waited for the cheque. That view, it is needless to say, is an absurd one to take, and the successful and practical grower is well aware of the care, attention, and knowledge required in conducting his business. In running through the set of slides he intended to point out the right as well as the wrong way of growing fruit, and in the first instance he pointed out that a judicious selection of the soil was of

first importance. Commercial fruit-growing—that is the growing of fruit for profit and not altogether as a hobby—was a costly undertaking. No regular or adequate returns could be expected for four years at least, and the cost of bringing an orchard to the productive stage might be put down at about

£40 PER ACRE.

It was therefore good policy to go through some preliminary trouble in securing suitable land. A deep loam, in a well-watered region, and within easy distance of a railway station or a centre of distribution, was more favourable than either heavy or sandy soils situated in either an arid locality or in a spot which for a part of the year may be water-logged, or which was at such a distance from market that the cost of carriage and the time spent on the road were out of proportion with the profits to be derived. Mr. Despeissis then threw on the screen slides showing the habits of roots in deep, free soil, and on soil overlying hard pan, and also the method of breaking up and preparing the soil for planting. Deep ploughing (he said) was a good preparation, and afforded greater range to root growth, encouraging them to strike deeper, and insuring a better supply of moisture and nourishment. It was a fortunate circumstance that under the conditions which controlled the climate of a great portion of the south-west corner of Western Australia—a corner representing in itself a territory of the size of England—a walk through an orchard almost anywhere would disclose the fact that such cold climate fruit as the apple and the pear flourished alongside heavy-bearing oranges and lemons. Whatever the choice of the kind of fruit it was intended to grow had been, it was essential to set them properly, *i.e.*, not too deep and not too high. With the beginner the inclination was generally to

PLANT TOO DEEP,

and this in the past had been a frequent cause of failure. Concurrently with the planting season, or, better, a little before, from June to August, in those orchards and vineyards that had been planted some time already, pruning was attended to. This afforded an opportunity of carefully inspecting the plants. Many blights and pests were detected at that period. For many, pruning was a practice more or less wrapped up in shrouds of mystery and the way one heard some people who had professed to know all about it speak of pruning would almost make one believe that it was a science full of mysteries conducted on laws and rules which can only be acquired by years of close study. There were rules, certainly, but they were easily mastered. They might be summarised thus:—

Heavy cutting back or pruning in winter forces fresh shoots and induces wood growth.

Judicious summer pruning prepares the tree to carry fruit, and tends to the development of fruit spurs and buds.

Root pruning, which is only occasionally to be recommended, checks the growth and throws the tree into fruiting.

Cincturing or bark pruning also assists the setting of fruit.

Spur pruning, or thinning crowded spurs, insures better setting and better fruit.

The lecturer then dealt with details. He spoke of the method of cutting to a bud, and differentiated between a fruit bud and a leaf bud.

The first is a small, flat, triangular-shaped bud which lies close against the bark, whereas the second is a plump, round bud, wrapped up in scales, and which stands well out from the branch which carries it.

The short pruning and long pruning of vines were described, and views were shown of a peach orchard with well trained trees, and a badly trained and pruned apple tree. A very interesting series showed a young apple tree before, during, and after both winter and summer pruning.

In referring to grafting Mr. Despeissis gave a recipe for grafting wax as follows:—Beeswax, 1 to 2; resin, 4; tallow, 1; or raw linseed oil, $\frac{3}{4}$-pint. The slides then showed grafting in various ways.

The principle of grafting was explained, as well as the importance of having the growing wood of both stock and scion in close contact. A callus is formed which acts as a cementing medium, and favours a healthy healing up.

Crown and bark grafting was shown on the screen, and also the whip graft and the ordinary cleft graft used for vines.

The lecturer then dealt with the packing of fruit for the local and export markets. The respective merits of the several packages, both Australian and American, were gone into. Grading as to kind, size, and colour was touched upon; also packing for the local and for the export markets. He showed some apples suitable for export—

Esopus Spitzenberg	Kentucky Red Streak
Newtown pippin	Stone pippin
Rhymer	Hoover
Cleopatra	Rome Beauty
Adam's Pearmain	Ben Davis,
Jonathan	

as well also as the following unrivalled Australian seedlings:—Dunn's seedling or Munroe's Favourite, Rokewood or Bullock's seedling, Wellington or Dumelow's seedling, Granny Smith—all good bearers and excellent keepers.

THE FOOD OF PLANTS.

FOURTH LECTURE.

By E. A. Mann, Government Agricultural Chemist.

Introduction.

A short while ago when visiting the Perth Mint we were frequently stopped in our progress from room to room owing to the necessity of the services of two men before certain doors could be unlocked. Each of these two men had their own key, and they had to be applied simultaneously before we could gain access to the treasures which were behind those doors.

It appears to him that that was a good illustration of the co-operation which must exist between the scientist and the experimentalist or producer before the treasures which nature so jealously guards can be fully disclosed—neither can do without the other; both are indispensable. It was his desire to lay before them one of these views and to speak to them from the standpoint of the scientist.

Composition of Plants.

When we come to examine the structure of plants we find that they are made up of cells of many different forms and sizes, but very similar as to their general structure, and the principal contents of these cells is a substance called protoplasm, which is the source of all the vital energies of the plant.

Now, when we come to examine the chemical composition of these cells, and of the contained protoplasm, we find that they are composed of comparatively few elements of the some eighty or so chemical elements known; only a small number are required for the plant, as shown by the following table:—

Composition of Plants.

		Per cent.
Water	...	50·00
Organic Matter	Carbon	23·50
	Oxygen	18·80
	Hydrogen	2·30
	Sulphur	1·20
	Nitrogen	1·20
	Phosphorus	Trace
Ash ...	...	3·00
		100·00

Analysis of the Ash of Wheat.

	Grain.	Straw.
Potash ...	31·1	11·7
Soda ...	3·5	2·0
Lime ...	3·1	7·2
Magnesia	12·0	2·6
Phosphoric Acid	46·2	5·4
Sulphuric Acid	2·4	2·9
Silica ...	1·7	67·3
	100·0	100·0

These elements, in some form or other, must obviously be applied to the plant as food; they may be divided into two classes, according to the source from which they are derived, namely, air or soil, and will be dealt with in this order.

Food Derived from the Air.

Carbon.—There is present in the atmosphere a gas called carbonic acid gas, which is present only to the extent of ·04 per cent. by volume, but is nevertheless the source of all the carbon in plants, a fact which would probably come as a surprise to many people who have not studied the chemistry of plant life. This gas is present in the air which is expired from the lungs of all animals, and is inimical to the life of animals. When exposed to an atmosphere attending certain proportions of this gas, animals are suffocated. He could not illustrate that by an actual experiment with animals, but would do so by the action of the gas on a candle flame, which is not only metaphorically but actually parallel to the flame of life in the animal.

The influence of this gas on animal and vegetable life illustrates the remarkable fact of the balance which is preserved in the workings of nature. Animals absorb oxygen from the air and give off carbonic acid gas, while plants absorb the carbonic acid gas and give off oxygen.

Plants make use of these gases by breathing, and it is necessary to explain somewhat fully how the breathing takes place; in order to do so he must first explain the diffusion of gases, which would be best done by means of one or two experiments.

The gases in the air diffuse into the interstices of the leaf through minute openings called stomato, or breathing pores, of which there are as many as 1,200,000 to the square inch.

By the laws of diffusion the carbonic acid gas gets access even to the interior of the cells and there comes into contact with little granules of a most wonderful substance called chlorophyll. This chlorophyll is the substance which gives the green colour to vegetation, and has the most remarkable property of being able to break up carbonic acid gas and from it build up the substances which form the structure of plants. This action can take place only in the presence of sunlight, but in the presence of sunlight chlorophyll can take the carbonic acid gas and work wonders with it. What is the exact nature of the action we do not know, but it is believed that the most probable steps are as follows:—

First the carbonic acid gas CO_2, together with water, are transformed by the chlorophyll into a substance called formic aldehyde. From formic aldehyde and similar bodies there can, in the laboratory, be built up substances of the nature of sugar, and these are very closely related to another large group of bodies called starches, and these are also closely related to cellulose. All these together form what are known as the carbo-hydrates, and for the information of those who may have some chemical knowledge, their relationship is illustrated by the following table, which must be taken, however, not as an absolute statement, but only as a probable explanation of what goes on in the plant:—

Use of Carbonic Acid by Plants.

$$CO_2 \quad H_2O = CH_2O + O_2$$

(Carbonic Acid) (Water). (Formic Aldehyde). (Oxygen).

$$6\,(CH_2O) \quad \ldots \quad = C_6\,H_{12}O_6 = \text{Glucose.}$$
$$12\,(CH_2O) - H_2O = C_{12}H_{22}O_{11} = \text{Cane Sugar.}$$
$$12\,(CH\ O) - {}_2H_2O = C_{12}H_{20}O_{10} = \text{Starch, etc., Cellulose.}$$

This theory is confirmed by the fact that during sunlight, that is, while the chlorophyll is exerting its activities, granules of starch can be discerned in the leaves which gradually disappear and are changed into other bodies or are disseminated throughout the plant.

Water.—Water in plants is partly derived from the air in the form of rain, etc., but is largely obtained from the soil and will be treated more fully below. This is important, however, as giving the necessary hydrogen and oxygen required for the actions explained in the last table.

Nitrogen.—Four-fifths of the atmosphere consists of nitrogen, but this is of no use to the majority of plants, so that with most plants, as far as nitrogen of the air is concerned, it is a case of starvation among plenty, like the old story of the man who had "Water, water everywhere, and not a drop to drink." Plants must have their nitrogen prepared for them, they can only take it in in certain forms, which will be explained later on in his lecture, and only one class of plants, so far as we know at present, can make direct use of the nitrogen of the air, viz., the leguminous plants, which, through the action of bacteria, which find a home on their roots in a wonderful way, are enabled to make use of this nitrogen. This is through

the action of bacteria only, and he would not deal with it at length, as Dr. Blackburne will be describing this fully in a future lecture.

From the Soil.

The most important substance taken from the soil by plants is water, first, because it serves as a source of hydrogen and oxygen for building up the plant products; second, because it is an almost universal solvent. All the juices of plants contain a large proportion of water, and just as the blood of animals is the conveyor of food to the various parts of the body so is the sap of plants. The soil water being, as I have said, an almost universal solvent, contains, in solution, the plant foods which it has extracted from the soil, and these being sucked up with the water into the plant are conveyed by the sap to the various parts of the plant.

It is very important to understant how the plant is able to get hold of this soil-water. It does this by a process known as osmosis. Pfeffer conducted experiments on the osmotic pressure of sugar ranging from 1 per cent. to 6 per cent., and obtained pressures amounting to from 10 to 60 pounds per square inch, equivalent to that exerted by a column of water from 24 to 137 feet high. It will, therefore, readily be understood how sufficient pressure can be obtained to drive the soil-water from the roots to the top of the plant.

Nitrogen.—The next most important plant food in the soil is nitrogen, which is specially necessary to vigorous growth. A very large number of plant substances contain this as an essential constituent, for instance, the albuminoids, such as gluten, in flour; these are particularly necessary for the formation of seeds where they form a supply of food for the young plant, which will eventually spring from them; therefore the supply of nitrogen has a very important bearing on the yield of crops. The plant albuminoids are also necessary for animal nutrition. It is these substances which go to make up the muscles and blood of animal life, so that here again for feeding purposes a good supply of nitrogen is necessary for the plant.

Animals require to have these albuminoids prepared for them by the plant, and just as the nitrogen must thus be prepared in special forms for animals so the plants must have their nitrogen in particular forms also, namely, that of nitrates. There are many forms of nitrogenous bodies, two opposite examples of which are horn and saltpetre. The one is insoluble and practically indestructible and cannot be utilised by the plant, while the other is soluble and is immediately available for plant food. The insoluble forms of nitrogenous bodies present in decaying organic matter (humus, etc.) must be broken down and then oxidised by the action of bacteria into the form of nitrates before they can be of any use. This will no doubt be more fully dealt with in a subsequent lecture of this course by Dr. Blackburne.

We now come to what may perhaps more properly be called the mineral constituents of the plant. These appear in the ash of plants; they do not, as a rule, form part of the protoplasm, some generally occur in the formof salts in different parts of the plant, and the question arises, what are these ingredients for? We do not know much with certainty, but this we do know, that though they are present only in small quantity they are very necessary to the life of the plant, and I will endeavour to show some of the ways in which this usefulness is exhibited.

Phosphorus.—This is contained in chlorophyll and is therefore very important, as shown above; it also has a wonderful effect on the diffusion of

NARROGIN.
Cattle on Messrs. Clayton and Rintoul's Farm, "Rosedale."

the plant albuminoids. These are first formed in the foliage of plants, and if left to themselves would not be sufficiently soluble to be distributed throughout the plant by osmosis. In connection with compounds of phosphorus these albuminoids form soluble combinations, thus enabling them to be distributed from cell to cell through various parts of the plant. They acquire by this means powers of locomotion just as a helplessly intoxicated man is made mobile by conjunction with a constable.

The form in which phosphorus occurs in the soil is that of phosphates derived originally in most cases from the natural phosphatic rocks.

Potassium.—Potassium is necessary for the formation of carbo-hydrates (starches, sugars, etc.) in some unexplained way. These starches are also formed, as I have already said, in the leaves, and are thence distributed to the plant by transportation from cell to cell, being assisted by the presence of potash salts in the same way as albuminoids are assisted by phosphates. It is, therefore, very evident how important potash must be to all plants which have a large proportion of starchy products consisting of starch or sugar, as potatoes or grapes. Potash and phosphorus also give stamina to the crop in which prolific growth is engendered by nitrogen. Without these you would get growth without stamina; with them you get growth, richness, and strength and yield. Potash of the soil, as a rule, is derived from felspars in the natural formations.

Lime.—Lime in soils is necessary to the life of plants because it assists in the conversion of starches into cellulose, and it is also of great importance to the soil, not only for its own sake, but because it assists in liberating other substances, such as potash, from the more or less refractory compounds in which it is present in the soil, and thus renders the potash available as food for plants.

Magnesia.—Magnesia is of importance because it is a necessary constituent of the all-important chlorophyll; it also assists in the transport of carbo-hydrates like potash.

Iron.—This is rather a peculiar plant food because, although it is not present in chlorophyll, it is in some way necessary to its formation, and often an application of iron soil to sickly grass land will restore a fine green colour to the herbage.

Silica.—In its ordinary form this is common sand, of which we possess such a plentiful supply. It was at one time thought that the silica gave rigidity and stiffness to plants, but this theory is now abandoned. We do not know exactly how it plays its part, but there is some evidence to indicate that it insures a timely and complete development and ripening of seeds.

These soil elements are not all of equal importance. Apart from the water, which acts as a vehicle, there are four principal plant foods: nitrogen, potassium, phosphorus, and lime. The others occur, as a rule, in sufficient quantity in all soils and do not need to be replenished save in exceptional cases, but these four may frequently be deficient, and a fertilising of soils is directed towards maintaining an ample supply of these foods so as to obtain a maximum profit from a crop. In connection with lime, some also have a secondary effect in liberating other constituents. [A number of slides were exhibited showing the influence of these ingredients on different crops, and illustrating their special actions as described above.]

Amount of Constituents in Soils.

In order to understand the quantities of these constituents, which are present in soils, and before giving the percentages which occur, it is necessary to show the weights of some typical soils to understand what the percentages mean.

The absolute weight of soils varies directly with their porosity, and is greater the more gravel and sand they contain. In the following table is given the weight per cubic foot of various soils according to Schubler, and likewise (in round numbers) the weight per acre taken to the depth of one foot (43,560 cubic feet):—

Weight of Soils.

		Per Cubic Foot.	Per acre to depth of one foot.
Dry silicious or calcareous sand ...	about	110 lbs. ...	4,792,000
Half sand and half clay	„	96 „ ...	4,182,000
Common arable land	„	80 to 90 „ ...	3,485,000 to 3,920,000
Heavy clay	„	75 „ ...	3,267,000
Garden mould rich in vegetable matter	„	70 „ ...	3,049,000
Peat soil	„	30 to 50 „ ...	1,307,000 to 2,178,000

From the above figures we see that sandy soils, which are usually termed "light," because they are worked most easily by the plough, are, in fact, the heaviest of all; while clayey land, which is called "heavy," weighs less, bulk for bulk, than any other soils, save those in which vegetable matter predominates. The resistance afforded by soils in tillage is more the result of adhesiveness than of gravity.

The standards generally adopted are shown in the next table:—

Standard for Good Soil.

	Total.		Per cent.
Phosphoric acid	P_2O	...	·15
Potash	K_2O	...	·20
Lime	CaO	...	·40
Nitrogen	N.	...	·25

Available.

Phosphoric acid	about	·02
Potash	„	·01

Soil Standards and Crop Requirements.—Exhaustion of Soil.

	Potash.		Phosphoric.
Amount required to be available in soil	·01%	...	·02%
In a soil weighing 4,000,000lbs. (1 foot deep) this means ...	400lbs.	...	800lbs.
A crop of wheat yielding 30 bushels of grain and 4,000lbs. of straw per acre removes	49lbs.	...	23lbs.
This soil, therefore, contains enough for about	10 years	...	35 years

The percentages seem very small, but you will see that these percentages really represent in the aggregate large amounts of material, and when compared with the amount removed by the crop are evidently enough to supply continued demands for some years. [The question of availability to the action of the root hairs was then fully illustrated on the lines described in a paper published in the August number of the *Journal.*]

The lecturer concluded by emphasising some of the points already brought out as to the special requirements of certain crops and the bearing

of these upon the question of the exhaustion of land, and with passing allusions to such important questions as maintaining the fertility of the land, rotation of crops, and mixed farming and questions springing from these, such as preservation of soil moisture, tillage, use of fertilisers, etc.

THE BEE.

FIFTH LECTURE.

Facts Worth Knowing.

By John Sutton.

The lecturer referred to the existence of three bees, the queen, the drone, and the worker. It was necessary to have one queen in the hive, and the success of that hive depended on whether she was prolific or not; because the workers died of old age during the summer months after a life of six weeks. Therefore, unless there was a queen that could supply sufficient eggs, the hive would dwindle away. In modern bee-keeping an endeavour should be made to keep the drone in subjection. The best strain was required to produce the drones, because on them depended the strain of bee that would be got in the future. With regard to the worker there should not be less than 40,000 in order to insure the commercial success of the undertaking. It was possible to have in one hive any quantity of workers from forty to a hundred thousand, but if one had the latter number and a prolific queen, that queen in summer would often deposit as many as from three to four thousand eggs in 24 hours. The lecturer passed on to the brood frame, and showed the capped cells of the worker, the drone, and the queen bees, and described the processes of hatching the eggs and the development of a perfect worker bee in the space of 21 days from the time of the laying of the egg. If the bees decided to swarm from any cause, then the workers selected one or more of those eggs that had been deposited, which would in the ordinary course develop into worker bees. They fed these, however, with a very strong food, called royal jelly, and each of the cells selected would make a perfect queen bee, which would hatch out in fifteen instead of twenty-one days. The first queen that left the cells might possibly destroy all the rest, or, if they happened to be too crowded, they might swarm out every three or four days until they reduced the hive and rendered it useless. Passing on to the manufacture of beeswax, he said that many people imagined that the bees gathered it as they gathered honey. The wax, however, was manufactured from the honey by the bee. The bees gorged themselves with honey, and then they clustered in festoons, and getting that cluster up to a given heat the wax left the underside of the abdomen in small thin scales. That was transferred from the bee's abdomen and made into honeycomb. Mr. Sutton touched on the antennæ of the bee, by means of which they discovered whether they were strangers to each other or not on coming into contact. He showed the uses of the various legs in keeping the body clean. The bees when diving into a flower in search of honey gathered pollen on their body, and became literally covered with that

flour-like substance. That pollen was made into a pellet, and placed in what was known as the pollen basket on the hind legs. He showed with aid of slides how bees worked on blossoms, and how it was necessary for the bee or any other insect—the bee, however, for preference—to gather the pollen and distribute it from flower to flower. Otherwise while there might be an abundance of flower there might not be any fruit. Dealing with what he called the business end of the bee, he stated that the bee had a double end; with one it gathered the honey and the other it used for purposes of defence. A person who knew anything about the handling of bees need have no fear about the sting. Referring to swarming, he stated it was a natural thing for them to do, but in modern practice instead of having to chase the bees and bring them back, the proper thing was to cut a little off one wing of the queen, so that when the swarm left the queen would not be able to fly. The beekeeper or his assistant should be at hand at that time, pick the queen up in his fingers, place it in a cage, be ready to remove the hive from whence the swarm had come, place an empty hive on the same stand where the other was taken from, put the cage containing the queen in front of that entrance, and the swarm would return to take possession of that hive. After the bees settled the beekeeper should examine the old hive and remove all the cells containing queens that he did not require. That would prevent a second or further swarming. He laid emphasis on the necessity for keeping the colonies strong, if the bees were kept for commercial purposes. Six hives of bees, fairly strong, would give greater results than twenty weak ones. When the honey flow came on and the bees were gathering freely, the keeper should keep in close touch with his bees, and as they filled the super with honey, he should remove it and give the bees an empty one beneath it, making them three or more storeys high. That would in many cases prevent swarming, and give better results as far as the honey was concerned. The longer the honey was kept the better it became. But provided a man removed from his hives a cwt. or even half a ton of honey that had already been sealed, and he took a few unsealed frames of honey, the latter, being unripe, would have the effect of destroying the flavour of the bulk. It was absolutely necessary that all honey should be ripened by the bee. Mr Sutton pointed out in conclusion that during the early season the beekeeper should have such knowledge as would enable him to know when it was necessary to feed his bees. A pound of feed in the shape of syrup given to the bees in the springtime was worth a ton of honey a few months later. The lecture, which was illustrated by many slides, all of which were fully explained, was listened to by many enthusiasts in beekeeping.

POULTRY.

SIXTH LECTURE.

By Frank H. Robertson.

The number of persons who think that there is nothing in poultry-raising as a profitable industry is becoming less every year, still there are a few remaining, and in most instances such is due to a want of information on the subject. To give an idea as to the really great magnitude poultry has

attained, the report for 1902 of the Bureau of Animal Industry of the United States of America supplies some remarkable figures, and makes the statement that the egg product of 1899 was valued at a higher figure than the combined gold and silver product of the United States during any year since 1850; the annual value being over £60,000,000 (60 millions) per annum. The importations of poultry and eggs into England exceed £7,000,000 (7 millions) per annum.

The poultry industry in Victoria is valued at £2,000,000 per annum, and this State of Western Australia, which, owing to its mild climate, is eminently adapted to poultry culture, strange to relate, has to rely very largely on importations of eggs, which for the year 1903 amounted to £80,000, thus showing an increase of over £7,000 for the previous year. This seems remarkable in view of the greatly increased interest taken in poultry-raising. The output of eggs has evidently not kept pace with the demands of our fast-increasing population. The residents within an area of 20 miles of the city of Perth are making great strides in poultry-raising, but the farmers in the wheat-growing districts have not yet taken to the industry as one would expect, but prefer to keep to the same lines which have paid them so well in past years, viz., the growing of crops for wheat or chaff, and, until they do, the importations of eggs will still continue. There are large numbers of persons engaged in egg-production who have to purchase all the feed for their fowls, and make it pay handsomely; therefore how much more profitable must it be to the wheat-growers, who have large areas of land and grow all their own feed.

Shade and Shelter.

To successfully rear fowls shade and shelter is the first item of importance, and the best is that provided by small bushy undergrowth. Birds exposed to the hot sun in summer and cold winds of winter will not yield a prolific egg supply, and if shade is absent it must be supplied by the erection of bough shelters until suitable trees are grown. The fig tree is one of the best to plant. It is a quick grower, makes splendid summer shelter, and provides a valuable marketable fruit. Another quick-growing tree is the castor oil tree, which has the advantage of holding its foliage all the year round; and for breakwinds the passion vine, if planted against wire netting, is very suitable, also producing a valuable fruit. Pepper trees and tree lucerne are also good and quick growers.

Grit.

If poultry are kept in sandy or other soils deficient in gravel, it must be supplied. Shell-grit can be purchased at moderate prices, but this should not be entirely relied on. Sharp, hard, coarse sand should be left about in tins for the fowls to help themselves to, and it is remarkable the quantity they will consume. Ducks in particular require it, and many of the failures in duck-raising can be put down to want of grit. The best way to give it to ducks is to place it in their drinking water.

Green Feed.

The regular supply of green feed is one of the troubles that confronts the poultryman, especially during the summer months. It therefore behoves him to grow the fodders that thrive best under the conditions of soil and climate of his particular district. Lucerne stands in the foremost rank, but

can only be grown in certain favoured localities. Rape is an excellent fodder, and should be sown just before the first rains commence. Kale and silver beet should also be grown; and if pie-melon seeds are put in during October an excellent substitute for green feed is obtained just at the time of year when green feed is scarcest. Failing all these means, use the greenest chaff obtainable, steam it well and mix with the bran and pollard. If good lucerne chaff is obtainable, so much the better, as its nutritive qualities are of a very high order. A good supply of animal food is another problem which must be solved if good results are to be obtained. Failing a supply of sheeps' or bullocks' livers and butchers' scraps, kangaroo flesh would be obtainable in some of the country districts; and I believe it would be worth while trying the experiment of raising goats in some localities. All fresh bones should be cut up by using a machine made for the purpose, and where blood is obtainable it should be used, as it is the highest concentrated form of animal food; failing all the above, artificial meat meals of good quality are now obtainable in this State at moderate prices.

Cleanliness.

Strict attention to cleanliness in feeding is absolutely essential. The chief thing to avoid is feeding the fowls on ground which is at all tainted with excreta; also sour or putrid foods and musty grains or meals. Overcrowding must be guarded against, both on the runs and in the fowl-houses; about 100 head to the acre, running all the year round, is sufficient; but this number can be greatly increased, if the rotation of pens is adopted, by turning over the soil and growing green crops. But in all cases the question of exercise must not be forgotten. The fowls, to keep in good health, must be made to work for their living; this they obtain if running loose about a farm, but if kept in pens the adoption of the American scratching-shed system is advised.

Diseases.

Poultry are subject to a great number of diseases. The following are a few of the most common:—

Warts on the comb, face, ear-lobes and wattles, if taken in hand at once, can generally be cured by touching the affected parts with pure phenyle. Growths in the mouth are often cured by placing a pinch of powdered sulphur in the mouth. Scaly leg can be easily cured by rubbing in a mixture of sulphur and lard. For cholera, coop up affected birds, give very little water, no hard feed, only soft food, such as bread crumbs, boiled rice. First give a dose of sweet oil, followed by chlorodyne, six drops every three hours. Beaten-up egg is the only food that should be given forcibly to sick fowls when being doctored to keep up their strength.

Bumble foot is easiest cured by cutting open the foot, removing all the cheesy growths, apply pure phenyle, bind up the foot carefully to exclude all dirt, and keep bird enclosed on soft ground for a few days; leave the bandages on for quite a month.

Crop binding may be cured by flooding the crop with warm water and emptying by holding the bird by the legs, removing a small quantity at a time. In many instances it is better to make an incision in the upper part of the crop and thus remove the contents, then sew up first the crop proper, using three stitches, then the outer skin. Feed fowl with small quantities only of soft food for a few days.

Roup.—Use any of the well-known advertised cures; but young stock affected with only a watery discharge from the nostrils, if eating well and looking bright, are better left alone, as they will shake off the complaint in a few weeks.

Lice on fowls is prevented by providing boxes with dust or ashes for the birds to dust in. Lice on fowls are immediately killed by using insectibane.

Lice in perches can be killed by the application of kerosene, but fowls should never be dipped in kerosene, as it is far too severe and often kills them.

The tick pest is best destroyed by burning down fowl-houses and re-erecting in a different locality; the new buildings to be built of iron with the wooden frame-work outside, and using tick-proof perches. Such houses should not be built against fencing or any other buildings. Larvæ tick on fowls only remain a week, then drop off, and afterwards live in the building, coming out at night-time only to feed on the fowls.

The habit of egg-eating by sitting hens can easily be cured by keeping the culprits supplied with egg-shells filled with a mixture of kerosene and mustard.

Breeds of Fowls.

If mongrel fowls are kept run with them only pure-bred male birds, purchasing sittings of eggs early each season to keep up the supply. Cross-bred fowls are to be preferred to mongrels, but to keep only one breed of pure-bred fowls will be found the most satisfactory. Let them have unlimited run, if possible, but if a nuisance in stables, barns, sheds, etc., use wire netting, and enclose the places fowls are not wanted to enter. As to breeds, there is no best breed of fowls any more than there is a best breed of cows. There is great differences in the laying qualities of individual birds, and anyone who likes to take the trouble can make a breed of great layers by watching the best laying hens and breeding from them. A quicker plan would be to buy stock from poultrymen who have stock of proved productiveness. The introduction of an egg-laying contest in this State would be of immense advantage as the means of finding out the breeders here who have good laying strains of fowls.

Turkeys should not be kept by suburban poultry-keepers with small runs. They thrive remarkably well in the warm districts where they have unlimited range, and are very profitable, requiring very little attention.

Fowls and ducks are best separate, but if kept together the ducks can be supplied with soft feed after the fowls have gone to roost.

More attention should be paid to geese-breeding, as they can be reared very cheaply in districts where there is a good grass supply, and are then very profitable; but they should be penned up for a fortnight and fattened before sending to the market. The same applies to ducks. It is false economy to send thin poultry to the markets, as they fetch poor prices. There is great room for improvement in the quality of the birds of all kinds for table purposes. The market was glutted last year with ducks especially in too thin a condition.

The simplest and best form of fowl-house is that made tent-shaped, of corrugated galvanized iron, models of which may be seen at the office of the Department, or at any of the agricultural shows, nearly all of which the writer attends with a large variety of models of houses, perches, drinking vessels, etc.

All perches should be the same height, not on the ladder system so frequently seen; 1½ to 2 feet from the ground is quite high enough. Perches should not be nailed to the side walls of the fowl-house, neither should they be firmly fastened to each other, but made so that they can be easily removed for the eradication of all insect pests.

Early Hatching.

Many persons leave the hatching of chickens too late in the season. The indifferent poultryman sets hens principally in October, November, December, and January, the smart man avoids those months, and commences about April, and continues right through the winter months, finishing off in October just when the other man is making a start. The advantages of early hatching are numerous, as the chickens thrive well, and lay when eggs are dearest. The late hatched stock are more liable to disease, are slow in maturing, and come on to lay when eggs are cheapest.

About Ducks.

Why do ducks, young and old, go weak on their legs, tumble about, and die quickly, is the question so often asked by persons in this State? The answer is want of grit, insufficient shade, and improper feeding. Ducks require more grit than fowls; even the tiny duckling should have some finely-crushed sharp sand with its first meal, and have access to same ever afterwards. Exposed to the sun will knock them over; also an exclusive grain diet will founder them. The natural habit of ducks is to dabble about in marshy ground abounding in succulent weeds, grasses, and such like, where also is to be found abundant animal food. Therefore, in keeping ducks artificially, follow natural methods as near as possible, viz., but little grain, plenty of soft greenstuff, or boiled vegetable and animal food and grit. This Department publishes a pamphlet dealing fully with the question of poultry feeding.

Artificial Incubation.

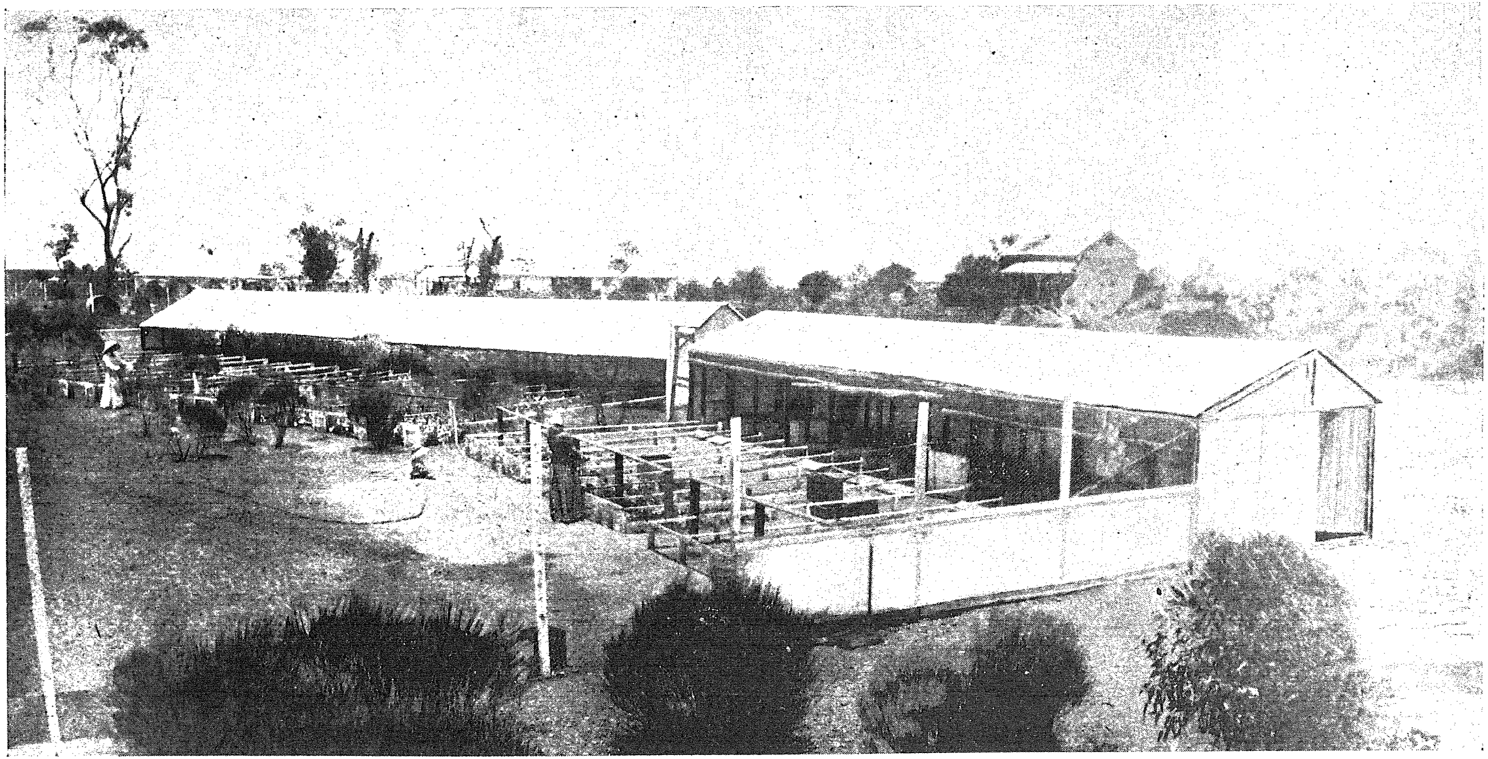
For raising poultry on a large scale incubators are necessary. They are also of great advantage in producing chickens and ducklings when broody hens are scarce. Want of attention to the instructions given by the makers account for many failures in working machines. Another frequent cause is want of sufficient ventilation in the room in which the machines stand. Purity of the atmosphere is a first essential. If there is any smell of stuffiness it should be taken as a warning to provide a better supply of fresh air.

GENERAL AGRICULTURE.

SEVENTH LECTURE.

By P. G. Wicken.

The seventh lecture of the series was given at the Department of Agriculture by Mr. P. Wicken on 4th October. The subject was "General Agriculture." The lecturer first dealt with the subject of improving the ground before planting crops by means of drainage, and also the necessity



KALGOORLIE.

THE BROODER HOUSES ON THE CARISBROOK DUCK RANCH. (Described in August Number of *Journal*).

of giving the ground a thorough working before sowing the crops. The subject of crops suitable to grow at the present time was then touched on, and information given as to the cultivation necessary. Lantern slides were shown of the following crops:—Brome grass, rye grass, *Paspalum dilatatum* grass, lucerne, clover, cow pea, soy bean, teocinte, sorghum, maize, etc., all suitable for planting at the present time. The lecturer gave figures showing the heavy yields to be obtained from these crops under Australian conditions, if the necessary cultivation is given to the ground. Having explained the best methods of growing these crops, Mr. Wicken stated that to make the best use of these crops it was necessary to have a regular supply of feed all the year round, and this could only be done by preserving the surplus supply at one period for use at a time of scarcity, by converting it into silage. The different methods adopted to make ensilage were fully dealt with, and slides were shown and explanations given as to the methods to construct, stack, pit, and tub silos; how to fill the same; how to apply the pressure; the difference between sweet and sour ensilage. The value of ensilage-making to the dairy farmer was pointed out, as in the form of silage the food is provided in a more succulent form than when made into hay, and also gives about three times the quantity; 10 tons of green feed giving, approximately, 10 tons of silage or three tons of hay. The lecturer also dealt with the subject of feeding sheep on rape, mustard, turnips, soy beans, and similar crops; the lecturer explained that to obtain the highest results from the sheep they should have access to only a small portion of the crop at one time. The best plan is to have a number of hurdles which can be put temporarily among the crops, and the sheep given a fresh supply every day, as by this means they do not tramp on the feed so. Rape is one of the best feeds for this purpose, and Mr. Wicken gave an instance in which he had obtained an increase of 847lbs. of mutton by feeding off $1\frac{1}{4}$ acres of rape by a mob of sheep, 38 sheep being kept for 40 days on the plot. The sheep were Romney Marsh and Shropshires, both suitable breeds for raising early lambs for market and for obtaining good weights at an early age. Another advantage of feeding sheep in this manner is that nearly all the crop is returned to the soil in the form of manure, and the succeeding crop is much improved thereby without the addition of other fertilisers. Rape being a deep-rooted plant brings up plenty of the plant food elements from the subsoil, these, when returned by the sheep to the surface soil, largely increase its producing qualities. The lecturer stated that to make the greatest profit from the crops grown, it was necessary to send them to market in a concentrated form and this was best done by feeding them to stock; to obtain the best results from the stock it was necessary that they should be well-bred animals capable of making the best use of the food supplied to them. A poor, badly-bred animal of any type will not yield a return for the food supplied to it, and whether breeding for beef, dairy purposes, pig, or sheep farming the use of the weighbridge for the food supplied and the increased condition of the animal will soon tell whether the animal is yielding a profit or loss and should be fed or disposed of accordingly. Particular emphasis was laid on the fact that only well bred stud animals should be used for breeding purposes, the sire, be he horse, bull, ram, or boar, is equal to half the herd, and stamps his characteristics on all the young stock, consequently, every effort should be made to obtain the best animals of every type. Typical animals of the various breeds of cattle were shown on the screen, as well as some of the champion prize winning dairy cattle of Australia. The lecture was well attended by an audience interested in agricultural subjects.

RINGING SHY-BEARING VINES.

By A. Despeissis.

With the return of the spring the grape vines send up fresh growth from spurs and rods of the previous year's growth, left by the pruner for that purpose, and these in turn show buds which, provided conditions are favourable, will blossom and set fruit.

Amongst vines, however, some are notoriously shy bearers under the ordinary treatment which govern the cultivation of vineyards. Uniform treatment cannot hold good in every case, and the individual peculiarities of some kind have to be studied and placated.

Thus some vines are pruned short, and others are pruned long.

Unless attention is paid to this need, the fruitfulness of the plant will be affected. It may overbear and run itself out, or it may, on the contrary, make rampant growth and remain sterile.

Some vines, amongst those which grow most luxuriantly, fail to fruit properly, be they pruned short or long, unless further help is given to them to set their fruit. Except in cases where malformations of the floral organs occur—and these are nowadays rare, owing to the universal system of selection of the cuttings from fruitful subjects only—a simple and easy minor operation which is rapidly done effects that result.

Where currant grapes are extensively grown in the Grecian Islands, "ringing" forms part of the routine of the annual work. In the dry regions of Cephalonia, where it was first introduced, the method is not now so general as it used to be, the ringed vines beginning to fail after two or three years. In Morea, on the other hand, where the soil is moister, ringing is more generally practised; although even under the prevailing favourable conditions met with it is found essential to restrict it to the more vigorous plants only, and care is taken that the same branch is never girdled or ringed in two successive years. Dr. Guyot, a keen observer, whose writings on the vineyards of France afford both pleasant reading and invaluable information, thus summed up the object and result of ringing vines as far back as the early sixties:—"Annular incision has now become a conquest assured, lasting, and most important in its bearing on the fruitfulness of the grape vine. Better setting of the grapes, enhanced beauty of both the bunch and the berries, earlier ripening by ten to fifteen days: such are its chief results."

In South Australia, where the cultivation of the currant grape has assumed important proportions, ringing has been found most helpful. There, however, it is reported that considerable harm has been done in some cases to the Zante currant vines of gigantic size it was the fashion to grow, by reason of the deep and severe cincturing of the main arms. Although the yield of the currant vines thus operated upon increased to a remarkable degree, it was found that after a few seasons the vitality of the vines was considerably impaired.

The object of these notes is not to discuss the best way of training Zante currant vines, beyond stating that the practice of a few years ago, which consisted of planting that vine apart and training it on high and costly trellises, is now giving way to closer planting and cheaper methods of training, and in other respects to somewhat similar treatment as is meted out to the general run of cultivated grape vines.

Apart from the currant vine there are others with an exuberant growth, which spend their energy more in the direction of wood and leaf growth than in that of fruit production. Others fail to ripen their fruit in localities which are hardly warm enough. Some again would prove more profitable if their period of ripening could be hastened by a few days. To all such vines the method of ringing explained in these notes is applicable.

In carrying out that method the usual system of pruning adopted need not be altered. Either spur pruned or rod pruned vines can be rung.

The Object of Ringing

is to insure a more equitable distribution of the sap among the wood and the fruit buds. By its means the growth is not materially checked, whilst the fruit receives better nourishment.

Best Time for Ringing.

The first question to decide before ringing is why is the operation made desirable? If it is meant to insure a "good setting" of the fruit, it is best done *immediately* before blossoming. In Western Australia this time would be towards the end of October for districts around the Swan, a little earlier for more northern districts, and a little later for the cooler districts of the South-West.

If it is done too early the wound may heal up rapidly, and the point missed; if too late, when the blossoms begin to wither away, ringing exerts no influence on the setting of the fruit. It is at the time of blossoming that Zante currants and other shy-bearing vines should be ringed.

If, on the other hand, it is intended to hasten the ripening or add to the size and the beauty of the grapes, then ringing may be done at any time up to the point of turning of the grapes.

How to Ring Vines.

The operation, which is a simple and an easy one, consists in cutting on the fruiting wood, and three or four eyes from the base, two rings only bark thick and $\frac{1}{8}$ inch between them, and removing the ring of bark. If the growing wood underneath is attacked, the rod may be so weakened that, unless secured against the trellis, it easily snaps in boisterous weather.

Some years ago I got from France a very handy and simple tool for ringing tender shoots of vines; it is called the "Follenay incisor," after the name of the inventor, and I have found it a great help in ringing Zante currants.

To insure prompt healing of the wound when old wood is rung, some experiments carried out in South Australia by Mr. Laffer, under the direction of Mr. A. J. Perkins, Principal of the Roseworthy Agricultural College,

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showed that it is advisable to bind up the incised ring with a strip of waxed calico. Rapid healing of the incisions is thus secured as compared with unprotected incisions, and the strain on the vine is said to be thereby greatly relieved.

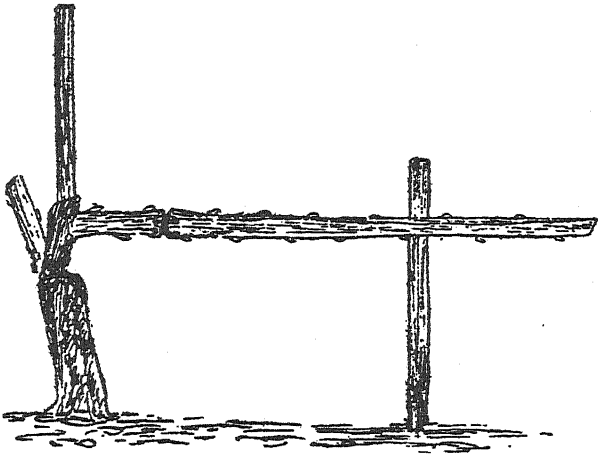


FIG. 1.—Long pruned vine (Guyot system), showing the long fruiting rod rung between the third and the fourth eye of the previous season's growth.

It is noted in the figure shown above that the short spur at the back of the long rod is not ringed. It will produce strong wood which will be used to continue the pruning of the vine when the time comes, in the winter, to prune the vine again. When that time comes the rod will be cut right off and replaced by a fresh rod, provided by the short spur seen in the figure.

This method of training and pruning has much that commends itself when applied to the Zante currant vine. A modification of this system, when the vine is strong and vigorous, is to have the double Guyot system or *Bordelais espalier* method of training, consisting of two short spurs and two long rods trained on wire, the rods being replaced by fresh ones each year.

Figure 2 shows how ringing can be adapted to a vine trained with permanent arms, as in the Thomery, Cazenave, or Sylvoz systems of training.

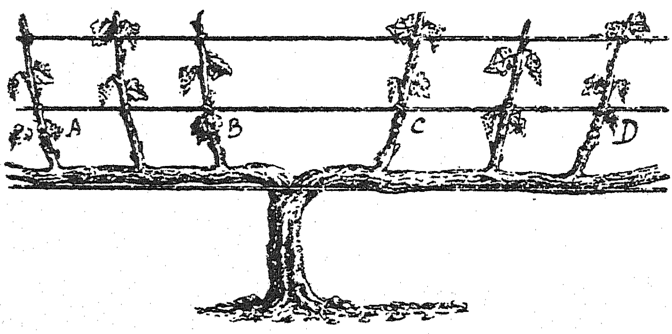


FIG. 2.—The letters A, B, C, D show rings on long rods of a trellised vine trained with permanent arms.

The incisions are practised two or three joints from the base. It is preferable to only ring every alternate rod, the leader is always excepted.

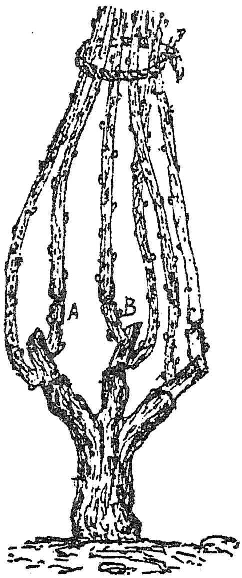


FIG. 3.—Ringing of the growing wood of a spur-pruned bush vine.

In the Cazenave pruned vines, and with vines pruned with systems of long rods and of short spurs along permanent arms, the long rods, as has been shown in the case of the Guyot pruned vine, are the only ones incised, and never the spurs, which are allowed to grow strong, healthy wood, without interference.

Besides these two methods of ringing, one of which is practically a modification of the other, it may happen that short spurred vines, trained bush fashion, may require ringing. In such cases, the short spurs themselves are never rung, but rather the shoot growing from the top eye of the spur, as is shown at A, B, and C in the figure. As the lowest arm on the spur is needed to supply wood for the next pruning, it is not interfered with, whereas the top cane being marked for removal when the pruning comes, it is immaterial whether its vitality has been impaired or not, if the object of ringing has been effected, viz., that of favouring a better setting of the bunches or an earlier ripening of the fruit.

These methods of training vines requiring ringing does away with the more severe operation of ringing the arm of the vine, which considerably reduces the vitality and the period of usefulness of the plant. There is no need of wrapping the incision with waxed calico to promote prompt healing; there is no occasion to plant Zante currants and other strong growing vines long distances apart, and train them on high and costly trellises.

In a vineyard not far from Avignon, in France, I saw, a couple of seasons ago, currant grape vines, both black and pink, just kept under control by this method of "annular incision," as the French call ringing, as fruitful, and vigorous, and healthy as any Zante currants I have seen in Australia. That method had been practised on these vines for years past without the slightest apparent strain on their store of energy.

Hand in hand with this ringing, it is evident that the vines must be generously manured, and the system can only be recommended in such places where the supply of moisture in the soil is adequate for supplying the needs of heavy fruiting plants.

ONION AND RHUBARB-GROWING.

A correspondent has written asking for particulars of onion and rhubarb cultivation. In reply to his letter the Director of Agriculture wrote to him as follows:—

Onions.

The best soil for onion-growing is a rich, well-drained loam. Heavy clay soils, hillsides, and stony land should be avoided. Excellent crops grow on rich, deep muck lands which have been under cultivation for three or four years. Such land should contain a fair admixture of sand, and the water-level be about two and a-half feet below the soil surface. It is a mistake to attempt to grow onions on weedy or run-down lands.

A heavy top-dressing of well-rotted barnyard manure should be applied in the spring at the rate of from 40 to 50 wagon-loads per acre, and well worked into the soil with a disk harrow or narrow-bladed cultivator. After this a complete commercial fertiliser, containing nitrogen, 4 per cent.; available phosphoric acid, 8 per cent., and potash, 10 per cent., should be applied. Onion soil cannot be made too rich. A top-dressing of ashes and hen manure might replace, in part, the commercial fertiliser, but the most successful growers as a rule use them all, and, in addition, from 250 to 750 lbs. of nitrate of soda, broadcasted, in, say, three applications, during the growing season. It must be remembered that it costs just as much to seed and cultivate a crop of onions yielding 300 bushels to the acre as it does to grow a crop giving, say, 800 to 1,000 bushels per acre.

Land once prepared for onions can be used for this purpose year after year, provided insects or diseases do not appear.

The rows should be 12 to 14 inches apart for hand cultivation, and about 30 inches apart for horse cultivation. From 18 to 30 seeds, according to vitality and danger from grubs, are sown per foot of drill, and covered to a depth of one inch. From three to six pounds of seed will be required per acre.

The best time to sow the seed is in April or May, so soon as the ground can be got properly ready after the first rains in April. A seed bed can always be advantageously used for the purpose of transplanting to fill up any blanks that might occur. This can be done at any time up to the end of September or the beginning of October, providing the weather does not get too hot.

Cultivation should begin as soon as the young plants appear, using a wheel hoe, which loosens the soil on both sides of the row and throws it slightly away from the plants. Hand weeding should follow promptly, and thinning if necessary. The plants should stand about three inches apart in the rows, but if the soil is rich they will stand crowding. If the soil is not sufficiently rich it will pay better to add more fertiliser to mature the crop than to go to the expense of thinning, unless of course the plants are altogether too close. Throughout the growing season the hoe must be used whenever weeds appear. The field will require to be gone over every 10 days or two weeks, but when bulbs begin to form cultivation must be lessened.

Rhubarb.

This is a very hardy plant, generally propagated by divisions of the fleshy roots. Pieces of roots are set in mellow soil in rows five feet apart, and about three feet apart in the row. The root pieces should be set in the ground with the crown about four inches below the surface. The ground should be kept well cultivated the first season, and stalks may be pulled the following spring. The soil for rhubarb should be kept extremely rich by the addition of an abundance of barnyard manure every other season. A good surface dressing of manure should be applied.

Rhubarb is also grown from seed. In growing from seed good, clean garden soil should be used, and the seedlings started in beds in the early spring, in rows 12 inches apart and one inch deep. Thin the plants to stand six inches apart, and cultivate through the summer. The following autumn or spring they should be set out in the field. The second season stalks may be pulled freely.

FRUIT-GROWING IN THE BLACKWOOD.

By Inspector G. W. Wickens.

The following report on the fruit-growing industry in the Blackwood district, showing the scope and profit attached to the work, will be read with interest, and it still further proves, if any such proof is required, that the Blackwood district is particularly favoured for most kinds of fruit production, although apples seem, so far, to do best:—

"Practically all the fruit grown in this district during the past season has now been disposed of, and for the information of the numbers of new settlers who are going in for fruit culture, I thought it would be interesting and instructive to obtain the results secured for the year by two well-known growers, whose orchards are situated in the Blackwood district.

"Mr. Godfrey Hester and Mr. R. Warburton have kindly placed their books at my disposal, and consented to the publication of the crops and receipts.

"Mr. G. W. Hester's orchard, Dalgarrup Park, which is situated at Hester's Brook, four miles from Bridgetown, is growing in rich red clay soil, and the growth of the trees and perfection attained by the fruit bears unmistakable evidence of the suitability of the locality for fruit production.

"Thirty acres have been planted, of which 14 acres are now becoming profitable, the remainder being comprised of young trees, ranging in age from one to three years.

"Apples, pears, plums, and peaches are all represented, but apples are the staple product, the principal varieties cultivated being Rome Beauty, Jonathan, Cleopatra, Nickajack, Lord Wolseley, and one other apple somewhat resembling Yates', the true name of which is not known.

"The Nickajacks, contrary to all accepted theories as to their shy-bearing propensities, were last summer literally covered with fruit. One eight-year-old tree yielded 14½ cases of marketable fruit, and 54 cases were gathered from five trees of the same age. Most of this variety were marketed during the months of July and August, and realised up to 17s. 6d. per case. In spite of the above interesting fact, I would not advise indiscriminate plantings of this apple, for I have known it for a long time in many places as a very disappointing cropper.

"Lord Wolseley is another apple doing remarkably well, though the trees do not attain any great size, due in a large measure to the heavy crops produced by them each year. This apple is one of the best in the orchard for storing, and realised as high as 14s. per case, in spite of the fact that it is only whitish yellow in colour.

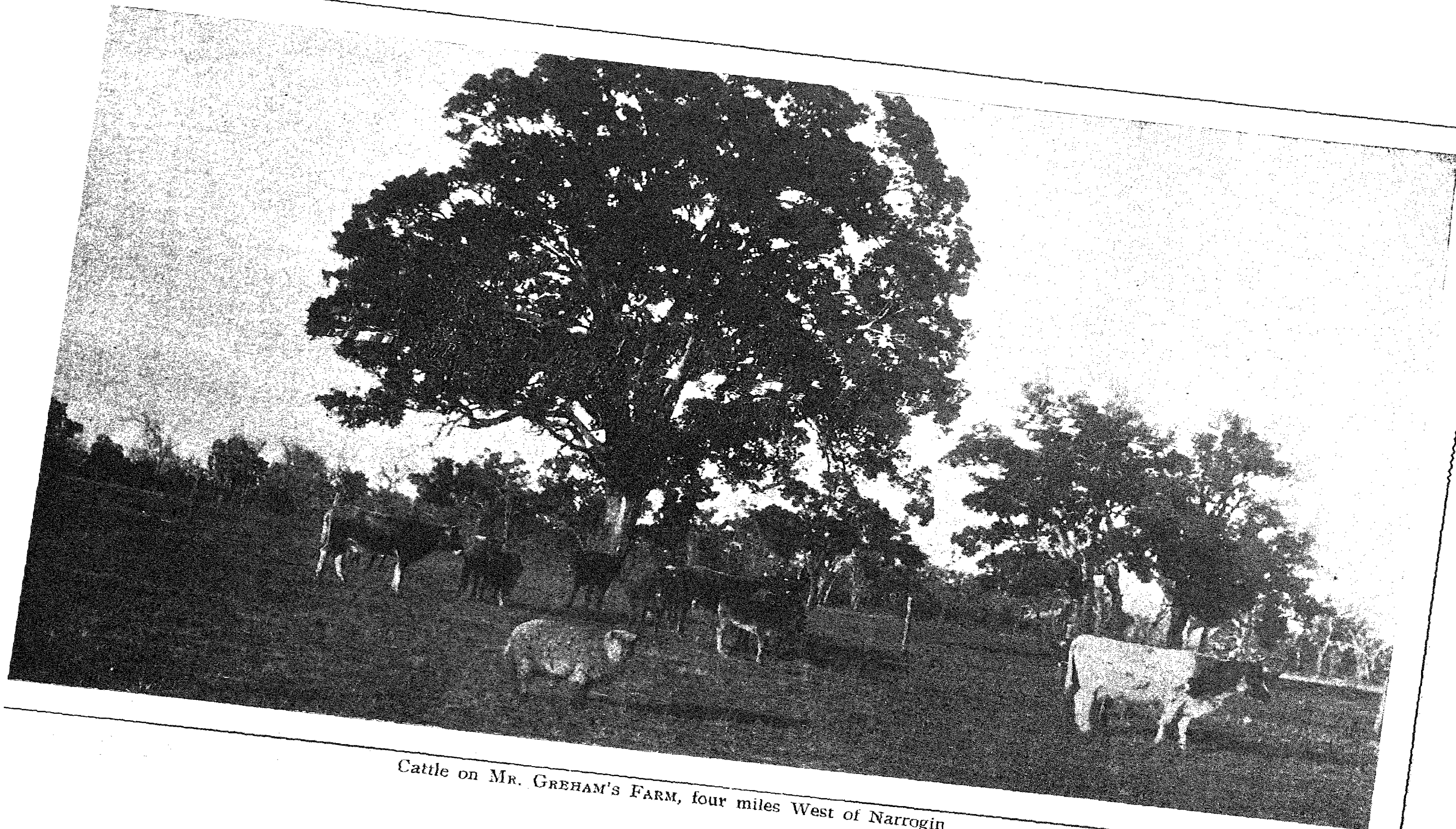
"Practically the only peach cultivated is Briggs's Red May, which, as a general rule, does well, and last year Mr. Hester planted out five acres of this fruit. Unfortunately, the present season does not promise too well for peaches. Not only in this orchard, but in many places throughout the district the buds are shedding before opening, a circumstance probably due to the heavy frosts experienced during the last days of August.

"From the 14 acres of bearing trees, ranging in age from four to nine years, the total number of cases of fruit sold during the season was 2,233 and the gross receipts were £902 4s. 2d., or an average right through of 8s. 1d. per case.

"Mr. R. E. Warburton's orchard, Brackenhurst, is also situated four miles from Bridgetown, and the soil is very similar to that at Dalgarrup Park. Twenty-two acres are devoted to the cultivation of fruit trees, nearly all of which are apples. The principal varieties grown are Rome Beauty, Jonathan, Cleopatras, and Rymers. Last year six-year-old Rome Beauty trees were splendidly laden, one group of this variety averaging eight cases per tree. Most of the Jonathan and Cleopatra trees also bore well, while the Rymers were exceptionally heavy.

"To show how well this orchard is cared for by the owner, I may mention that the Challenge Cup for the best-kept orchard, which was presented to the Nelson Agricultural Society by Sir James Lee Steere, and had to be won three years successively or four years intermittently before becoming the property of the orchardist, is now permanently on view at Brackenhurst. The bearing trees, whose ages range from six to eleven years, comprise about eight acres, and from this portion during last season were sold 1,250 cases, at an average price of 7s. 6d. per case.

"Mr. Sayers, the station-master at Bridgetown, has kindly supplied me with the following record of the number of cases sent from Bridgetown Station during 1903, 1904, and 1905. This only represents fruit grown in the portion of the Blackwood district close to Bridgetown, as well as most of



Cattle on Mr. Greham's Farm, four miles West of Narrogin.

the fruit grown at the Warren. Upper and Lower Blackwood fruit is consigned at stations nearer Perth :—

Fruit Record from Bridgetown Railway Station.

Month.	1903.	1904.	1905.
	Cases.	Cases.	Cases.
January	1,350	1,404	2,133
February	1,373	1,803	1,978
March	1,542	2,833	3,207
April	2,390	3,092	3,218
May	1,686	2,808	3,468
June	784	1,600	1,887
July	258	639	1,257
August	170	305	619
September	38	89	*122
October	—	37	—
November	—	—	—
December	111	108	—
	9,702	14,718	17,889
Increase	—	5,016	3,171

*To September 11 inclusive.

PHOSPHORIC ACID.

By Percy G. Wicken.

Next to nitrogen, phosphoric acid is the most important fertilising ingredient required by plants. Phosphorus occurs in nature combined with oxygen as phosphoric acid, and is known by chemists under the symbol P_2O_5, which means that two parts of phosphorus combine with five parts of oxygen and form phosphoric acid. Pure phosphorus is a soft, yellow, waxy solid, poisonous and inflammable. Phosphoric acid is usually combined with lime, iron or alumina. There are four lime phosphates used as fertilisers, and these are :—

(1.) Mono-calcic phosphate, containing water soluble phosphoric acid.

(2.) Di-calcic phosphate, containing reverted or citrate soluble phosphoric acid.

(3.) Tri-calcic phosphate containing insoluble prosphoric acid.

(4.) Tetra-calcic phosphate, contained in Thomas slag.

These phosphates have respectively one part of phosphoric acid united with one in mono-calcic, two in di-calcic, three in tri-calcic, and four in tetra-calcic, parts of lime. The third or tetra-calcic phosphate is the only one

found in nature, the other three being artificial products; it forms about one-half the weight of dry raw bone, and from one-half to three-quarters the weight of many mineral manures. In the trade these phosphates are known under different terms.

The mono-calcic phosphate is known as superphosphate, acid phosphate, soluble bone phosphate, acid calcium phosphate.

The di-calcic phosphate is known as di-basic phosphate, reverted phosphate, goneback phosphate, returned phosphate, precipitated phosphate of lime.

The tri-calcic phosphate is known as tri-basic phosphate, insoluble phosphate of lime, phosphate of lime, calcium phosphate, bone phosphate of lime.

The tetra-calcic phosphate is only known as Thomas' slag or odourless phosphate.

The phosphoric acid contained in the mono-calcic phosphate is readily soluble in water and available at once as plant food. In the di-calcic phosphate the phosphoric acid is not quite so readily available, but the acids in the soil soon act on it and make it available. The phosphoric acid in the tri-calcic phosphate, or insoluble phosphate of lime, is but slowly available to the plant, for the phosphoric acid is held by the three particles of lime in which it is contained. It has been found in practice that if a stronger acid, sulphuric acid, is added in sufficient quantities to a lime phosphate, the grip of two-thirds of the lime is transferred from the phosphoric to the sulphuric acid, thus loosening the phosphoric acid and rendering it soluble. Two of the parts of lime unite with the sulphuric acid and form gypsum or sulphate of lime, and the phosphoric acid is held by the remaining part, and therefore becomes mono-calcic or water soluble. This mixture, due to the treatment of tri-calcic phosphate with sulphuric acid, and composed of mono or soluble calcic phosphate and gypsum, is what is known in the trade as superphosphate of lime; its phosphoric acid is readily soluble in water and is of the greatest value to the farmer. If too little sulphuric acid is used, or if iron or alumia are present, a quantity of di-calcic or reverted phosphate is formed The reverted form is not dissolved by water, but is soluble in certain chemicals and is dissolved sufficiently in the soil to become available as a plant food. It is called revetred because it had been once soluble in water, and has reverted, or gone back, to its original state. In certain cases soluble phosphoric acid becomes reverted in the soil.

Phosphoric acid occurs in forms in which it is available as a fertiliser in

Bones	Phosphatic rocks.
Guano	Thomas' slag.

Bones are available in three forms: bone-ash, bone-black, and ground bone.

Bone-dust, bone-meal, or ground bone consists of bones which are simply ground or crushed, and their chemical composition is not altered in any way, the advantage being that, owing to their finer mechanical condition, they are more readily available as plant food. An average sample of bones reduced to powder contains about 3·5 per cent. of nitrogen and 20 per cent. of phosphoric acid; whole bones remain in the soil for a considerable time before they decompose, and their use cannot be said to be economical, as owing to the time they take to decompose the plant derives its food from

them in such small quantities that it is almost useless. Bones when crushed are much more effective, and the finer the product the greater the value as a fertiliser, owing to the smaller particles being more readily soluble in the soil. When put in the soil, the nitrogen contained in the ossein is converted by putrefaction into ammonia, and the phosphate of lime rendered soluble by the action of the carbonic acid and the vegetable acids. It is more particularly adapted to light soils, and is often disappointing in heavy clay, the reason being that in stiff clays it is more or less protected from putrefaction by the absence of air and moisture.

Boiled or Steamed Bones.—When bones are boiled or subjected to steam pressure in the vats, the ossein in the bone is gelatinised and mostly removed, while the fat is also removed, the remainder being therefore poorer in nitrogen but richer in phosphoric acid. Boiling or steaming bones renders them softer and more easily broken up, while the removal of the fat renders them more readily soluble in the soil, and hence boiled or steamed bones, or bone-meal made from boiled or steamed bones, is a quicker fertiliser than green bones although not quite so rich in nitrogen.

Bone-ash is the residue left after the bones are burnt, and consists principally of phosphate of lime, and the nitrogen is all lost during the burning. It is principally used in the manufacture of superphosphate.

Bone-black is made by charring the bones, which are placed in iron cylinders and exposed to heat in the same manner as charcoal is made. Bone-black is used principally by the sugar refiners for the purpose of removing the colouring matter from the syrups. After it has been used for this purpose it can be purchased at a low rate for a fertiliser, and, when treated with sulphuric acid and converted into superphosphate, forms the base of a number of fertilisers on the market. It contains no nitrogen, but nitrogen is often added to improve its value as a fertiliser.

Guano, which consists of the dried dung of sea birds, is found on a number of islands on the coast. When fresh it contains a small percentage of nitrogen, but this disappears as the deposit becomes older, and as a fertiliser it is principally valuable for the amount of phosphoric acid it contains as well as a small percentage of potash. Guano varies very much in composition, but if the samples are up to the guaranteed analysis in the contents of water soluble phosphoric acid, and the price is in accordance with the contents, it is a valuable fertiliser to purchase.

Mineral phosphates, or phosphatic rocks, are found in many parts of the world, and in the Australian States several such deposits are being worked. They are of very little value as a fertiliser in a natural state, but when treated with sulphuric acid form the bulk of the superphosphates sold on the market. Before treatment the phosphoric acid is contained in the tri-calcic form, and is consequently very slowly available as a plant food.

Thomas' Phosphate, or Basic slag, is a waste product in the manufacture of steel by the Thomas-Gilchrist or Basic process, and contains, in the form of phosphate of lime, the phosphorus existing in the original impure pig iron. The phosphoric acid, though insoluble in water, is somewhat more readily available to plant uses than that of other insoluble phosphates. It is largely used in Europe, where the price is low, but the cost of freight and handling makes its cost above its value in this State. It contains from 14 to 17 per cent. of insoluble phosphoric acid.

The before-mentioned fertilisers are all in the tri-calcic or insoluble form. To make them more readily available as plant food they are generally treated with sulphuric acid, which, as previously described, combines with some of the particles of lime and frees the phosphoric acid, which is then left in the water-soluble form and immediately available as plant food. The making of superphosphate from bones or from phosphatic rocks by means of acids is the business of the manufacturer, and has to be carried out on a large scale; the apparatus required for the manufacture of the sulphuric acid requiring the expenditure of considerable capital.

On a small scale, however, it can be made by the settler who has a quantity of bones at his disposal, as follows:—Provide a wooden trough lined with lead, or a small concrete tank will do, which the acid cannot corrode. The following ingredients are required: for every 40lbs. bone-ash, or of steamed or boiled bones from which the fat has been extracted, 15lbs. of strong sulphuric acid and one gallon of water. Place the total quantity of water in the tank and slowly add the acid, stirring gently all the time with a wooden pole. The acid combines violently with the water, and unless added carefully is likely to spurt out and burn the operator. Considerable heat is evolved during the mixing. After the acid has combined with the water, pour in the bone-ash, a little at a time, stirring it well up. If the mixture is correct, a stiff, doughy mass is the result, which, when left for a few hours, will become dry, and is easily broken up into a fine powder. It should be protected from rain while drying, and is then ready for use. Never add the water to the acid, but always the acid to the water.

If it is necessary to use green bones instead of ash or steamed bones, the resulting mixture is somewhat more greasy and requires different treatment; place the bones or bone-meal in the trough, and for every 20lbs. of bones add a mixture consisting of half-a-gallon of sulphuric acid and one gallon of water, stirring all the while. The pasty mass which results should be mixed with loam, wood ashes, or gypsum, to dry it, and it is then ready for use.

Under the Fertiliser Act, which will shortly be enforced, the percentage of—

Water-soluble phosphoric acid,
Citrate-soluble phosphoric acid,
Insoluble phosphoric acid

contained in a fertiliser have to be stated on every invoice, and in purchasing a phosphatic fertiliser it is only these ingredients which have any value. The water-soluble which is contained in the superphosphate is the most valuable, and is worth 5s. 2d. per unit, the citrate-soluble is worth 3s. 10d. per unit, and the insoluble 2s. 7d. per unit; while in bones, offal, etc., in which the phosphoric acid is contained in the tri-calcic or insoluble form, it is worth about 3s. per unit. The unit value is the value of each one per cent. of the ingredient contained in the fertiliser, and from the above it is easy to ascertain the relative values of any fertiliser offered for sale.

Another term often used in the trade is the quantity of phosphoric acid "available," and this is obtained by adding together the water-soluble and citrate-soluble phosphoric acid contained in the fertiliser.

The terms phosphate, phosphate of lime, and phosphoric acid are often confusing to a farmer. The terms phosphate and phosphate of lime are identical, but phosphoric acid, which is the ingredient we require in a fertiliser, is a different article. Phosphoric acid is always contained in phosphate of

lime in the proportion of 142 to 310; that is, phosphate of lime which may be said to consist of a mixture of 310 particles always contains 142 parts of phosphoric acid. This is represented by the fraction $\frac{142}{310}$ or about 45 per cent., or somewhat less than one half, and therefore when a fertiliser is stated to contain say 60 per cent. of phosphate of lime, it contains only about 27 per cent. of phosphoric acid. On the other hand, if phosphoric acid is mentioned, and it is necessary to know the percentage of phosphate of lime, we multiply by 2·2, which is approximately correct.

RAISING CALVES.

Experience with Substitutes for Whole Milk.

At a recent meeting of the Ayrshire Breeders' Association a paper was to be read by Professor Hayward, of the Mount Hermon School for Boys, on the above subject. It is very suggestive:—

How to rear calves economically is one of the most important questions that the dairyman has to meet. It would be an easy matter to let a calf run with its dam for the first six months of its life, but, while the calf would make a most excellent growth and be a thing of beauty, the practical dairyman —he whose living and taxes come from the dairy—realises that such a calf has cost more than it is worth and has been nearly, if not quite, ruined as a dairy cow. Perhaps it is safe to assume that it requires more skill to raise the dairy calf to-day than it did a score of years ago, for requiring more of our cows in the way of milk production, and subjecting them to a forced system of feeding, the calves are brought forth under more artificial conditions, and are, in consequence, less vigorous. It is desirable to raise the highly-developed calf with the least outlay, consistent with satisfactory results, which is an increasingly difficult task, as feeds are higher and dairy products relatively lower.

Briefly stated then, the problem is: Having given a more or less delicate, highly-organised calf, conceived and born under somewhat artificial conditions, to raise her with the minimum expense into a cow that shall be a maximum producer.

To start with a clear understanding of our task, it will be well to know something of the digestive trait of this calf. We should bear in mind that, in taking it from its mother, we are substituting an artificial method for a natural one, and that, while we have done and can do a great deal in appeasing mother nature with substitutes, there are certain physiological laws, inexorable in their demands, which must be satisfied if we desire the best results. One of these laws is that, until a calf has reached a certain age

or stage of development, the salivary glands do not act to change the insoluble starch of food into soluble sugar, and, in consequence, if the food containing starch is given before the glands are developed sufficiently, more or less irritation and indigestion will be caused. Milk does not contain starch, and is the most satisfactory food, under most conditions, for the first two weeks of the calf's life. The amount of milk required during this period depends upon a few important factors, of which the size and vigour of the calf and the composition of the milk are, perhaps, the most important. It is generally conceded that it is best, in most cases at least, to allow it to stay with its mother for the first six or twelve hours of its existence. During this time it will have gotten enough of the colostrum milk to start its digestive functions, while, on the other hand, it is not apt to overload its stomach to an extent that will cause digestive disorder. In my own experience we have fed calves, weighing 53 to 100 pounds, eight pounds of milk testing a little over 4 per cent. a day. This is equivalent to a little less than four quarts, and it produced satisfactory results. Figured even on an average retail price from the end of the colostrum period to the time the calf is two weeks old, the cost of this milk amounts to a small sum and can be afforded by any dairyman who is eager to raise a choice heifer calf.

Up to this time the feeding is an inexpensive and, of necessity, a simple matter. For the next eighty-five days, however, the problem is much more complex, and the feeder's ingenuity is taxed to the utmost. When the calf is weaned from the whole milk, one of two methods may be used for the next feeding period. The most natural, and by far the simplest and least expensive, consists in using the dairy by-products—skim milk, buttermilk, or whey. When properly fed, a pound of gain can be produced from about twelve pounds of skim milk. The most satisfactory results can be obtained by feeding grain of some sort with the skim milk. The Iowa Experiment Station found that sifted ground oats or corn meal, and a very little flaxseed meal with the milk, gave much more economical results than skim milk and linseed meal. This is attributed to the fact that skim milk, being very nitrogenous, needs a less nitrogenous grain to balance it. The amount of either skim milk or grain must be left to the discretion of the feeder, but, as a general guide, it may be said that a dairy calf should not gain more than one and one-half pounds per day for the first four months of its life, and a little less thereafter. Either extreme of condition should be avoided. A calf that is for any reason kept very thin cannot make the growth necessary for a strong, vigorous constitution. On the other hand, a calf kept too fat is not receiving the proper training to fit her for a profitable dairy cow. Whey is not a satisfactory food for calves, having but about half the value of skim milk for this purpose.

Although I do not know that it has ever been tested by itself, I believe that the various brands of skim milk powder promise to be good calf food, but, on account of their expense, can be used only under extraordinary circumstances, when fresh or skim milk is not available. They are soluble in water, contain all the solids of milk, and, while not quite so palatable as skim milk, can be fed.

GARGET.

Among the very common diseases of cows none is better known than garget. It is safe to say that there is no dairyman who has not had cases of garget in his herd. The causes are obscure, and the treatment, when any is given, is haphazard. The disease is not contagious, and most cases are very mild and get well without treatment. Sometimes, however, the attacks are severe and require attention. Occasionally garget or any other disease of the udder is only a symptom of some serious constitutional disease like tuberculosis, and in severe cases it is only common prudence to call in a veterinarian. The following from a bulletin of the Kansas Experiment Station gives a clear account of the nature of garget and its proper treatment:—

Causes.—Injuries (blows on the udder with stones, clubs, feet, or horns, from projecting nails or edge of boards, sharp or cold stones), exposure to sudden and extreme changes of weather, overfeeding on rich food, such as cotton seed, peas or beans, indigestion, sores on teats, or insufficient stripping of the udder; it also frequently happens that a newly-born calf cannot drain the udder completely; overstocking of udder for an entire day or more with a view to making a show of organ for sale purposes.

Symptoms.—Usually, the first that is noticed is the condition of the milk, which is watery, coloured with more or less blood and containing a clotted, stringy substance (casein). This is frequently followed by a white pus-like fluid and in many cases a very offensive odour.

In severe cases the first symptoms to be noticed are, first, a chill, with horns, ears, and limbs cold. This stage, which lasts from a few minutes to hours, is followed by a period of fever in which the horns, ears, and limbs become unnaturally warm and the udder is hot, swells and becomes more or less solid in one or more quarters. The muzzle is dry and hot; the temperature of the animal is raised, the pulse is full and rapid; the breathing is quickened. The cow has little or no appetite and she does not chew her cud. The bowels are more or less costive. The amount of milk is lessened and the flow may be entirely absent in the affected portion of the udder.

In mild cases many of these symptoms cannot be recognised, and the first ones noticed are the swelling, heat, and tenderness of the udder. If the trouble grows worse the tenderness causes the animal to straddle with its hind legs. If the cow lies down she will lies on the well side. The above troubles may disappear in a few days and the udder resume its normal condition. If not, it changes into a chronic form in which the symptoms partially subside. The result is, the udder, or the affected part of it, becomes dry or forms abscesses. In the case of drying up the parts may become hard and remain so permanently or only until the next time of calving. If abscesses are formed they should be opened by a competent person and properly treated. Should infection take place at any time (the entrance of disease germs into the affected part) the result may be serious and may even cause the death of the cow.

Treatment.—The treatment will depend upon the severity of the case and the stage in which the disease is discovered. If the animal is cold, two

ounces of ground ginger given in a pint of warm water, or any hot drink, may cut short the attack. This must be given from a horn or bottle. Blanket the animal and rub her limbs with wisps of straw, making her as comfortable as possible. Moist heat should be applied to the udder by using heated wheat bran in bags, held in place by strips extending over the loins, between the hind limbs and around the abdomen.

Should the udder be very painful and the animal feverish, fomentations of hot water, as hot as the attendant's hand can comfortably bear, should be applied for several hours, for about fifteen minutes at a time. This may be done by passing a sheet around the body with four holes cut for the teats and soft rags or bran packed firmly between it and the udder. After the fever has subsided, drench the animal with one or two pounds (depending on the age, size, condition and strength of the cow) of Epsom salts, with two ounces of powdered ginger, in a sufficient amount of water. When the purging has ceased, one ounce of saltpetre may be given daily. The udder will need constant attention for some time in the way of gentle rubbing with camphorated oil several times daily, at the same time gently removing all the milk by squeezing the teat, instead of pulling or stripping it. If this causes the animal too much pain, a teat tube may be used, but must be boiled thoroughly for five minutes each time before using. When the udder is not tender, thorough hand rubbing several times daily, with or without the camphorated oil, will aid in bringing about a normal condition.

DISTRICT NOTES.

KOOJAN AGRICULTURAL AREA.

By Inspector Thompson.

The Koojan Agricultural Area, situated on the Midland line, comprises about 9,414 acres, divided into 62 blocks. The country is practically all salmon gum forest land, well watered by the Moore River running through the area from north to south. The soil is a rich, stiff loam, well adapted for wheat growing, to which it is chiefly put. Off one farm alone £1,200 worth of wheat and 1,000 tons of chaff are sold annually.

The whole of the area has been selected, and every block is being well worked, some 2,650 acres being under crop this year.

There is a good school building, and the homesteads are, as a rule, substantial and comfortable. The estimated improvements amount to a little over £9,414.

MR. LANG'S FARM. Rope making out of odds and ends of binders.

NARROGIN DISTRICT.

By C. Erskine May, C.I.L.

I beg to report having made a flying visit to some of the selections to the east and west of Narrogin. During the trip I took many views by way of illustrating the rapid and substantial development that is taking place in this progressive district. It will be hard to realise—by those not conversant with the marked activity of our new selector—the fact that seven years ago the places where I took the photos. was virgin country. All the owners of the places visited are farmers from South Australia, who one and all expressed their entire satisfaction in the prospects of their adopted country. I met many new selectors who are having the inevitable uphill game of developing new country, and who, with the recollections fresh in their minds of the established farms they left in the sister State; sounded not a discordant note at their altered circumstances; on the contrary, as I said before, they one and all expressed themselves thoroughly satisfied with their venture. The young folks, who appeared very cheerful at their future prospects, told me they had no desire to return to South Australia. The neat and substantial homesteads these people have constructed to comfortably house their wives and families is in itself sufficient proof that they have come to stay.

One of the most interesting places I had the pleasure of visiting and conversing with the people was what has been locally designated as "New Jerusalem," about 26 miles East of Narrogin. The settlement, which comprises 21 different contiguous holdings, embraces 9,600 acres and is occupied by 61 souls. These people, who are Christianised Jews, have emigrated from Bayswater, Victoria. The originator of the apparently happy band is Mr. J. C. M. Fisher, who, with his able sons, decided on selecting this fine belt of agricultural land, about three years ago, as their future abode. Mr. S. and S. R. Fisher, who have been the longest on the land (3 years), have to-day 150 acres under cultivation, and a considerable amount of fencing, etc., has been done. On the various holdings about 750 acres have been brought under the plough, and a fair proportion of the entire area has been ringbarked and neat slab dwellings erected. Each holder works his land entirely on his own account; they all, however, work in unity, *i.e.*, if one requires assistance in building, fencing, or clearing, the others help. They appear to be one large happy family.

The next place visited was J. K. McCracken's, in the Wickepin Area. He holds about 1,020 acres, about 22 miles from Narrogin. During the seven years he has been on the land he has cleared and cultivated 280 acres, 740 acres ringbarked, and erected a considerable amount of substantial fencing. His average yields have been 14 bushels and two tons of hay to the acre. He owns 250 sheep and 25 head of large stock. The next farm visited was ("Langville,") the property of W. Lange, who left South Australia three years ago with his wife, two daughters, and ten able-bodied sons, to settle near Narrogin. The father and seven sons hold between them 6,000 acres. In the short space of time they have been on the land they have cleared 140 acres, planted one acre under orchard, and built a fine substantial dwelling, outhouses, etc. The Lange's, like others I came in contact with, are well pleased with the future prospects. Mr. Lange forms a striking illustration of what can be done by a little thought. Nothing in consequence is wasted, even to the scraps of binder twine off the sheaves of hay, usually thrown aside as practically useless, is stored away to be converted into rope. For this purpose Mr. Lange has constructed a somewhat

crude machine out of the crown wheel and pinion of an old one-horse chaff-cutting works. This is employed to turn a spindle attached to three hooks for twisting the twine. In my presence, and in less than 10 minutes, a neck-rope was made out of odds and ends of binder twine; and for similar rope farmers have to pay at the rate of 1s. per lb. at the local shops.

The picturesque farm known as "Torbling," the property of Mr. Greham, is situated a few miles west of Narrogin. This is only a recent selection, but during the few years Mr. Greham has held the land he has cleared 270 acres, planted six acres of orchard, and has three acres under lucerne, and constructed a neat little dwelling, outhouses, etc., in addition to substantial fencing, about seven miles. Mr. Greham is depasturing at the present time 15 head of cattle (principally Jerseys), 25 horses, pigs, and about 150 fowls (Silver and Golden Wyandottes), etc., etc. His average yields have been 16 bushels of wheat, 25 bushels of oats, 23 bushels of barley, and 25cwt. of hay to the acre.

The well-known farm of "Rosedale," the property of Messrs. Clayton and Rintoul, was visited. This land was selected about five years ago, and to-day it is one of the most up-to-date farms in or around Narrogin. Mr. Clayton (the working partner) has about two miles of one stretch under cultivation, and five acres of orchard. He has six acres under *paspalum dilatatum*, looking very strong and healthy. Other plots are being put in under English and American grasses. There are at present depastured at "Rosedale" 1,000 sheep, 50 head of cattle (principally Ayrshire and Shorthorn), Clydesdale horses, etc. The crop averages have been 16 bushels of wheat and 35cwt. of hay to the acre.

There were several other places I visited, of which much could be written.

BRIDGETOWN DISTRICT.

By C. Erskine May, C.I.L.

During the month of August I paid a flying visit of inspection to the Bridgetown district.

With regard to this district I would like to draw special attention to the valuable alluvial flats intervening and the rugged hills that are admirably adapted for intense culture. There is probably no district in the South-West division better suited for horticulture, viticulture, or rooted crops generally. It would appear from the fact of the land lying vacant that the would-be orchardist is either not aware of the capabilities of the soil or the provisions of Section 60 of the Land Act, whereby five to 50 acres can be selected under liberal conditions for gardens. Should intending settlers require conformation of the statement as to the capabilities of the soil, they need only travel along the Boyanup-Bridgetown railway for ocular demonstration of healthy, vigorous looking orchards.

There are two other matters I wish to draw attention to, especially at this season of the year, which is of vital importance to selectors, yet so often disregarded. There is an old saying that "an onlooker sees most of the game." This applies forceably to an inspector of lands. There are no officers of the department who have better opportunities or more varied experience than the inspector of studying the methods, or want of same, of our selectors; they see the selector in all his stages of advancement, from the

time the land is taken up till the time the selector reaps the reward of his labours. It will, I think, be readily admitted by selectors that in the inspector, whom they know to be conversant with their trials in the first stages of development, that they have a sympathetic friend and adviser. The matters I desire to refer to are the valuable gifts supplied by nature—water and grass—which at this period of the year is in superabundance throughout the South-West Division. The success of our agricultural districts is due to our never-failing copious rainfall occurring at the proper time of the year. It would be a difficult matter at the present time to find a creek or watercourse that is not sending an abundant supply of water through properties that in a few months hence will be sadly in need of a water supply, owing to the want of a little forethought and labour for its conservation. There are farmers, in the minority I am glad to say, who, it would appear, prefer to cart water, or drive stock long distances rather than test their own land for water, or conserve a sufficient quantity that annually flows by their doors. If farmers to whom I refer were to compute the time lost in travelling stock to water during the dry months of the year they would realise the necessity of making provision for their own supply.

As regards grass, its intrinsic value, like water, does not appear to be always fully realised. With the advent of early rains, luxuriant pasture, especially in the ringbarked paddocks, is in abundance from June to December, and yet little, and frequently no stock to consume it. The nutritious pasture is often left bleaching in the sun ready for the bush fires of the summer, which not only make a clean sweep of the feed but often a good deal of fencing. For seven months of the year, when the feed is at its best, the land should be returning a handsome profit in fattening stock. Between June and December the land will carry, on an average, in ringbarked country, a sheep to two acres. As an example of the profit in grass I might mention that at the present time store sheep are obtainable at 17s. per head, in two months' time they can be fattened and realise, on an average, 23s. per head. Thus a profit of 3s. per acre for grass.

I recently saw a pig killed which had been entirely grass fed to within three weeks of its slaughter, when it was "topped up" in grain to sweeten the meat and solidify the fat. This pig (dead weight) turned the scales at 270lbs., and this at 6d. per lb. The usual price on the farm also demonstrates the profit that is to be made out of grass.

ALMA AGRICULTURAL AREA.

By Inspector Thompson.

The Alma Agricultural Area, which is about three and a-half miles north of Northampton, contains about 9,237 acres of good land.

This area was, a few years ago, a paddock, being portion of a pastoral lease and held by one person. There are 46 lots surveyed, all of which (with one ore two exceptions) are being fenced, cultivated, and otherwise improved, on which is settled about 25 people.

This land is some of the finest cereal growing land in the State, having an ample rainfall for wheat growing; and it is, in my opinion, some of the best, if not the best, land for growing barley. The crops that are in are looking well, and with anything like a fair season will be above the average.

This is one of the latest areas to be surveyed in this district. Most of the settlers being newcomers, they have all been busy making homes for their families, fencing, and clearing. Some of them are from South Australia, and after having had a good "look round," travelling through the Great Southern and South-Western lines in search of land, they have settled here in preference to any other place they had seen.

There is still land north of this area to be selected suitable for cultivation, and settlers are turning their attention to it; but some of them naturally want to get closer to the railway, and are taking inferior land for that reason.

The water supply on this area is ample, the subsoil is good holding ground for earthwork tanks, and there is a good rainfall; water can be struck at a reasonable depth—none of the wells are more than 35ft. deep, and all contain permanent water.

When the settlers on this area have established themselves and start cultivating on a larger scale, it will be found that Alma will be one of the best areas, in proportion to its size, for farming in the State; and with a little summer irrigation at the start, fruit trees should do well.

The total amount of improvements effected on this area is, approximately, £1,292 19s., and is comprised as follows:—Buildings, £176; water supply, £104; 125 acres ringbarked, £6 5s; 233 acres cleared, £332; 153 acres cultivated, £76 10s; 10 acres gardens, £160; 155 chains subdivision fences, £51 10s; 1,289 chains boundary fences, £386 14s. Total, £1,292 19s.

DARKAN AGRICULTURAL AREA.

By A. G. Hewby.

The Darkan Agricultural Area contains 12,070 acres, well timbered with white gum, red gum, and jam, while the soil ranges from very rich chocolate to poor gravel; the latter, however, is only found on the top of some of the rises. Of the total area, 9,470 acres have been selected; the balance (2,600 acres) has been temporarily withdrawn from selection.

There is a constant demand for land throughout the district, and many of the present settlers have expressed a wish that the reserved 2,600 acres should be thrown open for selection. The prospect of the opening of the railway (now being constructed) at an early date has induced the settlers to get a large part of their holdings under cultivation.

Water has been obtained practically all over the estate, the deepest well being 70 feet. The settlers, up to the present, have been chiefly occupied in raising sheep, and they have deservedly obtained a high reputation for the standard of their wool and mutton.

Twenty-three miles of sheep and dog-proof fencing and 24 miles of six and seven-wire fencing have already been erected; while 314 acres have been cleared, 180 acres of which are under cultivation, and 16 acres planted with fruit trees; 320 acres are partially cleared; 3,260 acres have been ringbarked. Buildings to the value of £2,000 have been erected.

The total amount expended on improvements on the whole area is estimated at £5,846, or a little over 12s. per acre.

BROOKTON DISTRICT.

By John A. Hall.

Since my previous visit to this district, some twelve months ago, I have had an opportunity of noticing the progress made by the various settlers, most of whom were only just making a start at the time of my previous visit.

Most of the month was passed in country east of Beverley and Brookton, and, as I had been through this locality twelve months ago, I had an opportunity of seeing the progress made by the various settlers, most of whom were just making a start at that time.

Extensive settlement has taken place in this region, and now there is hardly an acre of land suitable for cereal growing vacant between the railway and 30 miles eastward.

Many of the settlers, having come from the "otherside," are experienced farmers, and it is evident from the amount and nature of their improvements that they have unbounded faith in the country of their adoption.

The Qualin country, which was taken up 15 months ago by Mr. L. A. Withall, who was previously a farmer in the old country, has been considerably improved by buildings, fencing, wells, clearing, and about four acres of orchard.

Mr. Withall has great faith in being able to utilise the sandplain which stretches away to the eastward, and for this purpose has selected about 2,000 acres of it. He intends testing it with various grasses to see if any particular one will grow sufficiently to carry stock.

In a paperbark swamp on his holding he has planted some "paspalum" D, which was in splendid condition when I saw it, although it had been under water for three weeks until a couple of days previous.

As there are a number of swamps and watercourses of this nature along the Great Southern Railway which are at present considered worthless, it would be a considerable asset to the pastoral industry if this grass was successfully grown on them.

Numbers of the settlers are trying the sandplain for wheat-growing, there being five or six settlers in this locality who have cropped areas extending from 20 to 50 acres. Most of them are looking well, standing from 6 to 10in. high, but it is too early yet to judge the result likely to be obtained.

The crops throughout the district are looking well, and should yield slightly above the average obtained last season, although they have been put back considerably by the cold weather and frosts experienced during the past month.

Educational facilities are urgently required in the country east of Brookton, there being between 20 and 30 children of suitable age in this locality who get no schooling whatever, but I understand the Education Department have the matter under consideration, and no doubt a school will soon be erected in a central position.

VICTORIA DISTRICT.

By Inspector W. Thompson.

During the two months that I have been stationed in the Victoria District I have inspected five agricultural areas (besides doing other urgent inspections), from Koojan area in the south to Alma on the north, and have had a fair opportunity of seeing what the old farmers and the new settlers are doing with the land. At Koojan, which comprises about 9,500 acres, and which is all selected, there are 15 farmers who are living on and working their farms, and it would be hard to state which one of them is the most progressive, for every one is working the land for all it is worth, and have over and above completed their improvements, as most of the land is cleared and ploughed, and on the 9,000 acres there is hardly enough firewood to light a fire for the purpose of boiling a billy. Not that the traveller requires to do this, as a more hospitable lot of people could not be found anywhere.

Messrs. Ferguson, Holmes, McKinley, and Tolhurst Bros. have all large areas under cultivation, which will be cut into chaff or kept for wheat, according to the season, and if the present weather conditions continue, a good crop is assured. From this small area alone over 1,000 tons of chaff go annually, mostly to Perth, and what I saw was a remarkably fine sample.

The land is chiefly salmon gum country which the old settlers would not look at for wheat growing, but which is now acknowledged to be the best in this particular district. Mr. McKeever, who holds land on the northern portion of this area, has cleared all his land and has had to seek elsewhere for more. He is starting a new place on Moora agricultural area and hopes in a year or two to have that all cleared. This is the sort of man required to tackle these salmon gum forests, and transform them into the splendid farms they are to-day at Koojan.

Mr. Padbury's Koojan farm adjoins this area on the south, and this is what might be termed an ideal farm, with its large areas under cultivation, its comfortable brick homestead, large barns, stable, and outhouses, and everything in good order and condition. To the west of the area is a huge sand plain 14 miles across, and then comes the noted Yatheroo country which has been written up so often that it is not necessary to describe it again. This splendid estate would, moreover, require a report for itself.

On the east of and running parallel to the area is the Midland Company's railway, on which the company, for the convenience of the settlers, and possibly for their own benefit, have placed a siding called Elsternwick, and on the other side of the line are the company's lands. These are practically in their virgin state—barren—for a peculiarity of these salmon gum forests is that grasses do not grow until the trees are ringbarked.

Moora Lots.

There is a small area between Koojan and Moora townships, a distance of about two miles, which is surveyed into suburban lots for cultivation. These have all been sold, and if the price paid per acre for these lots is any indication of the prosperity of the people in and around Moora, the place should surely progress. Most of the holders of these suburban lots have ringbarked them, which is found to be the cheapest and best way to clear these lands. They are also fencing them in. Others are holding for

speculative purposes, and when their time for complying with the conditions of sale have expired will have to forfeit if the improvements are not effected.

Dalaroo Area.

The Dalaroo agricultural area is situated to the north of and adjoining Moora townsite, and here again the farms are being well worked. Every block is selected, and there is a large area under cultivation, and the crops are looking remarkably well. From Moora to Dongara by train, through the Midland Company's lands, and seeing the fine country, especially around Three Springs and Canamah, lying idle when it should be growing wheat, makes one regret it is not Crown lands and available for selection.

Dongara and Greenough.

If I were asked which was the best land I had seen in the State when travelling from Albany to Northampton, I would say "the land around Dongara and Greenough Flats," for it would be hard to find land anywhere which is better. It could be put to better use, however, than it is at present.

I am told that in the early days of this State nearly all the flour used in Perth and Fremantle was grown on "The Flats," and I have no doubt that nearly all the flour required for the use of those cities to-day could be grown there if the land were not kept to run a few sheep and cattle only.

There are two flour mills now in this locality, but I understand only a limited supply of wheat is ground. What is wanted is a Piesse in this district to make "The Flats" a second Katanning, where the mill runs day and night all the year round.

I firmly believe that a great deal more cultivation would be proceeded with in this district if there were means of getting the wheat away other than by train to Fremantle; and were the farmers to charter a boat and export wheat (and exportation on a large scale will have to come sooner or later) it would hold its own in any market.

Chapman Area.

The Chapman area is situated about 25 miles from Geraldton, in a north-easterly direction, and is mostly all selected, there being only about 20 blocks left. This area is especially adapted for mixed farming, for the wheat and hay crops now growing are looking well and the orangeries and orchards, which have been established for some time, look splendid. This land was included in a station paddock a few years ago, and was considered one of the best paddocks for sheep.

The Chapman Experimental Farm on this area has proved, and is proving, what can be done with second and third class lands. The farmers in this locality, I am told, often visit and inspect the crops, etc., from time to time, and are clearing and preparing second-class lands on their holdings for cultivation. A feature of this institution is that good, clean seed is distributed over the district through its agency, which the settler can buy from the farm. This means a decided advantage to him, as the seed he used to buy could not always be relied upon.

There is still land to the north and east of this area available for selection. York Gum flats are surrounded by grazing country, suitable for mixed farming, which is the farm that pays, for it is the man who succeeds who

does not carry all "his eggs in one basket." One settler near this area, who goes in for fruit growing, is making not less than £400 a year from this source alone, besides going in for sheep farming, pig and poultry raising, etc.

Travelling from Chapman on the way to Northampton, "The Bowes" station, owned by Mr. W. Burges, is met with. These fine paddocks are all well stocked with a splendid lot of sheep, cattle and horses; and, judging from their condition, the quality of the land for grazing purposes cannot be surpassed.

It seems a pity that the railway line between Geraldton and Northampton, which at present runs through, for the greater part of the way, barren country, hugging the coast for the greater part of the journey, was not taken up the fertile valley of the Chapman River and then on to Northampton. This line, I believe, was the first railway laid in Western Australia, and was built for the convenience of the mines in an around Northampton.

Northampton.

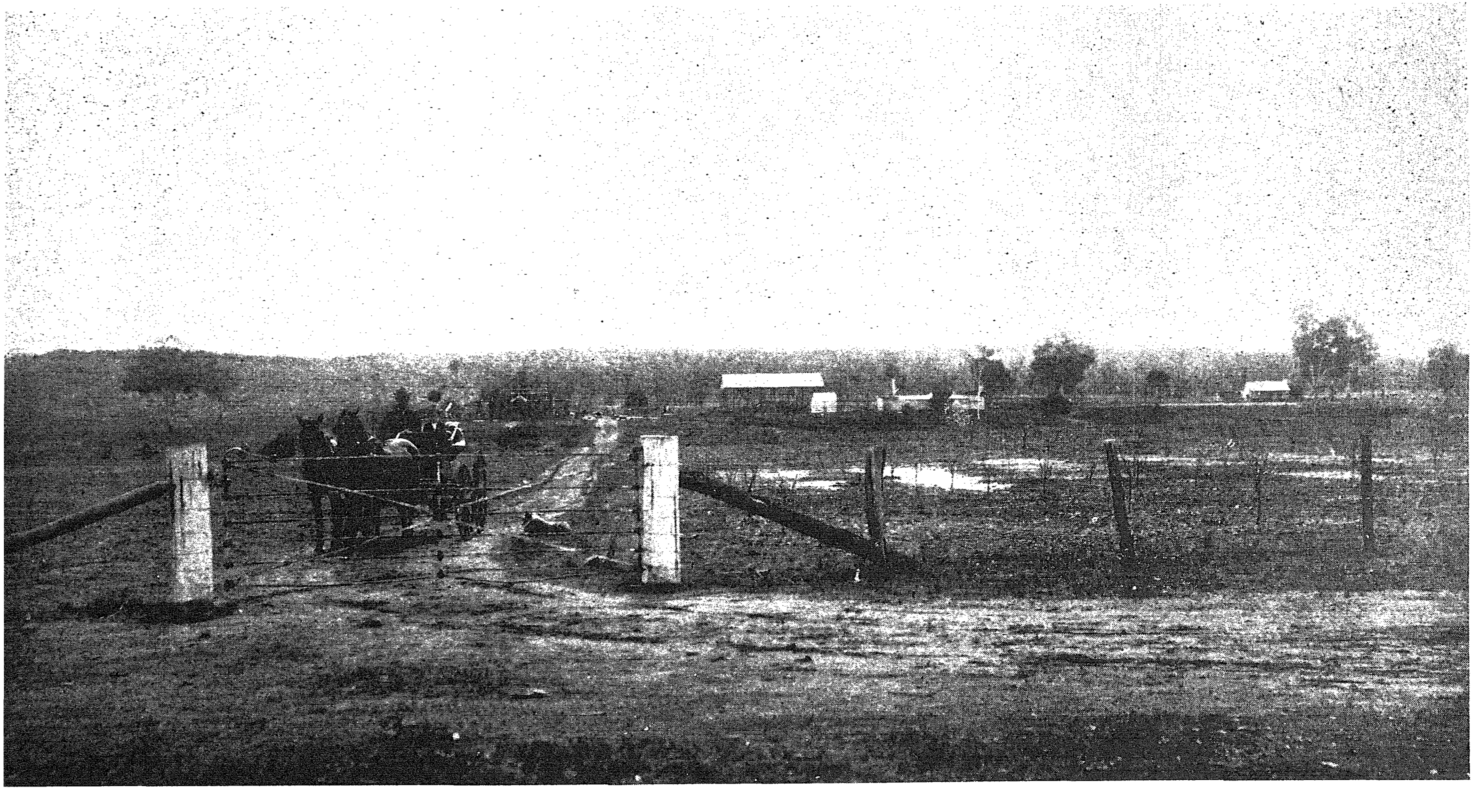
Northampton claims to be one of the oldest townships in the State, and shows to-day what the fate of a mining township is when mines cease work; and looking at the abandoned mines, smelting works, etc., it seems there must have been good cause for such an outlay of capital, and is is hard to believe that all the minerals have been found. The inhabitants of Northampton themselves live in hope of the mines starting again, and so give the town and district another good start. If this should happen and the mines proved payable, I would predict a great future for Northampton, for, with the Appertarra, Norga, and Alma agricultural areas around it, even without the mines, it must become a thriving centre.

A trip around this agricultural area would surprise some of the older settlers on the Great Southern and South-Western railways, and it would, I believe, be a revelation to them to see the splendid soil suitable for agriculture, and the excellent crops looking so well so far north. The general belief down south is that this portion of the Victoria District is only fit for grazing a few sheep at certain times of the year, whereas it is a second Blackwood for the quality of its land, and water can be obtained anywhere at a depth of 30 feet or thereabouts. The classification of the lands in the Geraldton and Northampton districts, carried out some time back, has done a great amount of good, as most of the lands have now been selected, and it would, I consider, be a good plan to have other plans prepared further out from information gathered as before.

FARMING IN THE SOUTH-WEST.

By Inspector S. H. Whittaker.

The most advanced farm for its age in the South-West is that of Mr. T. W. Hardwick, who, about two years ago, purchased 1,000 acres on the Harvey agricultural area, near the Waroona Railway station. Within two years 200 acres have been cleared, 15 miles of cyclone fence erected, large draining operations carried out, and buildings erected upon a very liberal scale. Most of the property is divided into 20-acre paddocks; there are 62 chains main drain, 6 feet by 4 feet 6 inches, and about 100



NARROGIN.
Clayton and Rintoul's Farm. General View of "Rosedale."

chains of smaller drains, discharging into the Government Drakesbrook canal. Ten acres are drained with field pipes, which are laid about half-a-chain apart. The homestead has two residences, and quarters for men, containing four bedrooms, dining-room, kitchen, storeroom, and bathroom. There are capacious stables, barn, machinery, and cart sheds, loose-boxes, loft, feed-house, storeroom, and a well-appointed double-lined dairy, in which the summer temperature does not rise to 60deg. The drafting-yards for sheep and dip, the pigsties, and the tank system, supplied by a windmill for watering stock, are admirable; while a shearing-shed and wool store are about to be erected. The Drakesbrook main drain that runs through the paddocks has been substantially bridged in two places. Ten acres of *paspalum dilatatum* grass have been laid down and 20 acres are to to be sown this spring. Last summer 40 tons of stack ensilage were made; the pressure being applied by ratchet and cables, and this feed has been much relished by the stock. Water is distributed to the homestead, dairy, etc., and to the various paddocks from overhead tanks that are fed by pumping from a permanent freshwater well on the edge of the brook. The drinking troughs are fitted with ball-cocks, and all over the estate expense has not been spared to make a well-appointed farm on which labour may be employed to the best advantage. The property is an example of practical, well-conceived plans and liberal expenditure. "Oakbank," as the farm is named, affords an opportunity of showing what are the capabilities of the South-West under a proper system of development.

FLOWER FARMING IN AUSTRALIA.

By Mr. JOHN PLUMMER, of New South Wales.

Although nature has become largely replaced by science in the manufacture of choice perfumes and essential oils, the demand for flowers for industrial purposes in various parts of the world is being steadily maintained, and in Europe and America flower-farming is conducted on an extensive and remunerative scale. Yet in the countries of the Commonwealth, so rich in plants yielding delicious perfumes and valuable essential oils, little or nothing has been done, so far, to practically utilise the advantages thus afforded. Systematic flower-farming is still in its experimental stages, and there exists an almost untouched field of illimitable extent at the command of those possessing the necessary capital and experience in the manufacture of perfumery and essential oils, coupled with the advantage of an abundance of mutton fat, so largely used in the perfumery trade, at minimum prices. In Australia all the garden flowers of Europe and Asia, especially those emitting the richest fragrance, are found growing in unsurpassed luxuriance, many being obtainable nearly all the year round, their profusion and cheapness proving how easily they are reared. Several of the essential oils

obtained from the leaves of native plants are really perfumes, and their chief use is in scenting soaps and other preparations. The quantities used are small, most of the plants being wild. Among the native perfume-yielding plants which remain unutilised are several varieties of acacia, including a few which furnish a scented wood. The *Acacia farnesiana*, which is largely cultivated in Italy and the south of France—the well-known pomade, called "Cassia," being produced by placing the sweet-scented flowers in melted mutton fat or olive oil, until the latter become impregnated with their odour—grows plentifully in many parts of New South Wales and other States; and another species of acacia, familiarly known as the golden wattle, is equally useful as a perfume plant; as is also the native laurel or mock orange. Among the plants from which sweet-scented and other oils may be obtained are the native sassafras, peppermint, bloodwood, blue gum, mountain ash, white gum, ironbark, woolly butt, spotted gum, tallowwood, messmate, red gum, poplar box, and other species of eucalyptus; ridge myrtle, tea-tree, native peppermint, dogwood, and turmeric. The essential oil of the red gum has been found a reliable remedy for chronic dysentery and diarrhœa, and that of the Moreton Bay ash makes an excellent furniture polish. The oil obtained from the native sassafras resembles, in odour, ordinary sassafras oil, with an admixture of oil of caraways, and is used for medicinal purposes. Eucalyptus oil possesses many valuable qualities, and is said to possess the power of destroying bacteria, or animal life. Its antiseptic powers have been fully recognised by the medical profession, and by many it is preferred to carbolic acid in the treatment of wounds. The leaves of the various kinds of eucalyptus are found useful in preventing or removing scale in boilers. The oil of the mountain ash, a common species of eucalyptus, dissolves gutta-percha readily, and can be used, like kerosene, for lamps, having a greater illuminating power, a pleasant odour, and absence of liability to explosion. Three ounces of the oil have been found sufficient to scent eight pounds of soap, at a cost of one farthing per pound. The oil obtained from the stringy bark is found to be more efficacious, in many complaints, than the ordinary English peppermint, being less pungent and more aromatic. The oil of the white gum has been suggested as a soap perfume. The woolly butt oil possesses the remarkable property of imparting an indelible stain to paper, but at present it has not been utilised for commercial or industrial purposes. The oil of the grey gum possesses a delicious citronelle odour, and makes an excellent soap perfume. Several varieties of the tea-tree furnish an oil possessing most, if not all, of the properties of cajuput, so largely used in India as a remedy for rheumatism. Practically, the number of native shrubs and trees in the Commonwealth capable of being utilised in the manufacture of perfumes and essential oils is without limit, and when the large quantities of either product, obtainable from comparatively small proportions of bark or leaves, is taken into consideration, it will be seen that in this direction Australia possesses exceptional advantages for those possessing the requisite capital and experience to establish large and remunerative productive industries. It may also be mentioned that the olive, castor oil plant, and linseed grow luxuriantly in the Commonwealth and are easily cultivated.

WOOLLY APHIS.

An interesting fact, proving the ease with which orchard pests are spread from once place to another (says Mr. N. W. Wickens, Inspector under the Insect Pests Act), came under my notice during the trip just completed through the Warren district, and as the circumstance mentioned is rather uncommon, I am sending an account of it to you for publication in the *Journal*, if you think it is of sufficient importance.

In the summer, three years ago, an apple was brought from an old orchard in which some of the trees were infected with woolly aphis, to a small young orchard 10 miles distant in which this pest had not made its appearance. The apple was eaten and the pips planted out later in the season. Two vigorous seedlings resulted. One, as far as can be seen, is free from disease; but the other has this season developed woolly aphis.

The only explanation of the occurrence seems to be that aphides, or their eggs, must have been on the pip at the time of planting, though this is a very unusual and difficult part of the fruit for them to infest; and the many chances they had of not surviving the treatment, which, after all, they successfully negotiated, speaks volumes for their powers of reproducing their species.

By the way, an entirely erroneous statement that I frequently hear orchardists make, is that woolly aphis comes out of the sap of the tree itself, and a tree once subject to its attacks, will always be subject; the disease, according to their idea, being an internal and not an external complaint. Certainly when cases occur where its origin in an orchard is as obscure as the one I have mentioned, the growers may be excused when they imagine that the trees are literally sweating out woolly aphis through the pores in the bark.

While on the subject, I may mention that a pear tree in Manjinup orchard, Balbarrup, was last year infected on one of its branches with woolly aphis, the insects having lived long enough on the spot to cause the unsightly swelling so common to blighted apple trees. Up to that time I had never seen woolly aphis attacking the wood of pears.

NOTE.—That the woolly aphis came on the pips of an apple brought and eaten on the ground is certainly possible, although the assumption is hardly probable. The insect could have been carried to the place in a number of ways. The pruning knife or saw, the hands of the operator, his clothes, could have been the means of conveying the woolly aphis from one garden to another. Some apples hollow at the core, picked from a blighted tree, often show woolly aphis in the cavity, and then the insect can be carried long distances. That insect is peculiar to the apple, and to some kinds more particularly than to others. It has been known, when apparently hard pushed, to attack pears, but I have never either actually seen or come across any authentic reference of pears being permanently attacked by them.

DAIRY FARMS.

REPORT ON A COMPETITION.

Mr. A. Crawford, the acting Under Secretary for Agriculture, who judged the competitions in the Wellington district for Mr. Teesdale Smith's prize for the best-kept dairy farm, writes:—

"In reporting on this year's competition, I regret to say that there were only two competitors—Messrs. Foster Johnston and Partridge. The first prize was awarded to Mr. Johnston, who obtained a total of 229 points out of 303, Mr. Partridge obtaining 216 points. The following table will show how many points under each head each secured over the other:—

	Johnston.	Partridge.
Breeding and uniformity	—	5
Feeding arrangements...	3	—
Cultivation green feed, provision for summer feed	6	—
Pasture paddocks, shade, shelter, and water	4	—
Milking sheds, convenience, drainage, etc....	3	—
Dairy utensils ...	even	even
Dairy buildings, convenience, drainage, suitability	even	even
Bookkeeping, cost of production, value of individual cows, dates of service, calving, etc.	7	—
Arrangements for calves	even	even
Condition of herd	2	—
General cleanliness and neatness	—	1
Condition of buildings...	—	1
Utilisation of waste products	even	even
Minor industries	—	5

"Mr. Johnston's books showed very clearly the value of each cow per week and per month, but not of the individual cow. The net returns per month were also shown, the cost of wages and feed being accurately kept and deducted from the gross revenue. Mr. Johnston had a larger area, proportionate to the number of cows, of summer feed prepared or in preparation, and better variety of crops. The condition of herd was also better. In fact, I would like to remark that I never have seen a milking herd of cattle in better condition. Mr. Partridge's herd were much more uniform as regards breeding, but lacked condition. He also lost marks as regards the bookkeeping arrangements. The pasture paddocks might also be improved by more of the scrub being cut without interfering with the requisite shade and shelter. In many of the paddocks many better natural and artificial grasses might be grown with much benefit. Mr. Partridge has two silos above ground, and is one of the few dairy farmers that has gone in for this up-to-date method of conserving fodder for feeding cattle in this State. In general cleanliness of dairy and dairy utensils, there was but little left to be desired by either competitor."—*West Australian.*

BREEDING HORSES WITH ACTION.

To breeders of harness horses the question of how to obtain plenty of action in their young horses is of the greatest practical importance.

High-trotting Action

adds very greatly to the value of any kind of harness horse, and a breeder who wishes to make the breeding of horses pay cannot attach too much importance to this quality. However good a harness horse may be in other respects, it will not command much of a price if it is devoid of action; and the better and higher the action is in harness horses the more valuable are they in the market. Action can only be got by breeding for it, as it is primarily a hereditary quality. It is, of course, possible to effect considerable improvement in a young horse's trotting action by special modes of training, but it is obvious that one cannot improve the action when it is not there at all. No amount of training can turn a harness horse that is devoid of action into a well-actioned animal. The principal thing, therefore, is to breed horses which are by nature endowed with high-stepping, trotting action by inheriting this quality from the parent stock.

Parentage should have Action.

In breeding harness horses, then, the breeder must pay plenty of attention to the action in the horses which he breeds from. To obtain the best and highest possible trotting action, both the sire and the dam should be possessed of plenty of action. Unfortunately, the horse-breeding farmer finds it anything but easy as a rule, and very frequently quite impossible, to carry out this desirable arrangement in practice. In selecting suitable brood mares from which to breed a good and saleable stamp of harness horses, there are several other points of importance besides the action which must receive due consideration. Important as the action is, it is not practicable, neither is it desirable, to lay sole stress on this quality to the exclusion of other important and indispensable qualities in the selection of brood mares for harness-horse breeding purposes. So far as regards the question of action in the brood mares, the best thing that can be said to horse-breeding farmers is to seek for as much and as good action as possible, but without in any way neglecting any other important quality, and paying due attention to the various practical considerations which are connected with the selection of suitable brood mares by the practical farmer. Where the choice lies between a good mare with only moderate action and a bad mare, whose principal recommendation is

High-stepping Trotting Action,

the former is most decidedly much to be preferred for breeding purposes to the latter. A strain of Hackney blood in a mare always adds to and improves her suitability for harness-horse breeding purposes in so far as concerns the question of action. It should here be pointed out that in the case of crossbred mares it is not by any means a foregone conclusion that a brood mare which is a good mover will transmit equally good action to her

progeny. It not infrequently happens that the progeny of a good-moving mare is inferior to her as regards action, disappointment thus being caused to the breeder.

Stallions which are used as sires of harness horses should always possess good action and move well, and when the breeder is selecting a stallion to mate with his mare or mares for the purpose of producing harness horses, he must lay great stress upon this matter. As a general rule, it will be found that the sire exercises a greater amount of influence upon the action of a foal than the dam. Although there are not infrequent exceptions to this general rule, the breeder cannot go wrong if he takes this rule into practical consideration in breeding harness horses. Thus better and higher actioned horses are, as a rule, bred by breeding a high-actioned stallion to a mare devoid of action, than when the mare possesses the good action and the stallion is devoid of it.

The transmission of his action by a stallion to the foals which he gets depends, of course, upon his impressiveness and prepotency as a sire. The more prepotent and impressive the sire is the more effectually will he transmit his good action to his stock. A stallion that has proved himself to be an impressive sire and very prepotent should, therefore, always be selected in preference to one whose qualities as a stock-getter are not known to the breeder. By using an impressive stallion with good and high action, the breeder may hope to breed foals with fairly good action, even from mares that possess no action, as, if the sire is prepotent, his foals will take after him in their action, the dam's want of action being entirely neutralised through the impressiveness of the sire. If we want the best possible and most brilliant harness action in the stallion we

MUST GO TO THE HACKNEY

breed. In point of brilliancy and showiness of action no other kind or breed of horses can touch the Hackney. Hackney stallions of good class are certainly most suitable for getting high-actioned harness horses, but, of course, they must be mated to the right and a suitable stamp of mare if the Hackney cross is to result in the production of really saleable harness horses. As has already been remarked above, it will not do to sacrifice other important considerations and points entirely to the quality of high action in breeding harness horses for sale. For this reason the Hackney cross is not by any means always the best. The brood mares in possession of the breeder may not be suitable for breeding to a Hackney stallion, but may require to be put to a stallion of some other breed.

Although thoroughbreds do not possess showy trotting action, and generally are low-actioned in their trot, yet there are some thoroughbred stallions which are quite suitable for getting harness horses of the carriage horse stamp, provided they are mated to the right class of mare. Some thoroughbred stallions possess quite passable trotting action, and such a one should be selected by the breeder of harness horses when he wishes to use the thoroughbred cross. In using a thoroughbred stallion it is, of course, necessary that the mares should be good movers if good action in the progeny is to be obtained.

TO PREVENT MOISTURE LOSSES BY EVAPORATION.

An important question with most farmers in arid districts is how to prevent losses of moisture by evaporation. These losses are often greater than most of us realise.

Losses by evaporation, when the upper soil is well supplied with moisture, may amount to an inch of water in four days. In our laboratory, with little sunshine and no heavy draughts, moisture evaporates from an uncultivated surface of 24 inches above standing water at the rate of one inch in 13 days.

Cultivation is the means usually employed to prevent evaporation losses.

By cultivation is meant stirring or loosening of the upper layer of the soil, and may be accomplished by means of the plough, harrow, weeder, or cultivator.

Water cannot rise so rapidly through a loose soil as through a compact one.

Generally the deeper the stirring the more complete the saving of moisture. In a laboratory experiment in which the soil surfaces were 24 inches above standing water, single cultivations, one inch, two inches, three inches, and four inches deep respectively, resulted in savings over no cultivation, as shown in the table.

In this case it is seen that the deeper the cultivation the greater the saving of water. This will be true for all soils probably.

SHOWING EFFECTIVENES OF DIFFERENT DEPTHS OF A SINGLE CULTIVATION DURING A PERIOD OF TWENTY-ONE DAYS.

Depth of cultivation.	Losses in tons per day.
0 inches	10·4
1 inch	5·19
2 inches	3·36
3 inches	3·16
4 inches	2·86

Losses in inches.	Per cent. moisture saved.
1 inch in 10·89 days	0
1 inch in 21·83 days	50·6
1 inch in 33·72 days	67·7
1 inch in 35·85 days	69·6
1 inch in 39·61 days	72·5

It is generally believed that the more frequent the cultivations the greater the saving of moisture. Generally speaking this is true so far as studied for clays, loams, and possibly for sandy soils. It is not true for all soils. Soils rich in organic matter, such as the muck soils, profit by single cultivations.

In practice it is found that, with cultivated crops on the soils indicated frequent cultivations with cultivator, barrow or weeder, not over two inches deep, prove most satisfactory.

It is found too, in practice, that those who are most persistent in frequent shallow cultivating find it profitable practice.

A layer of dry soil is much more effective in preventing moisture evaporation than a layer of like depth of moist soil, and so it is sought by many, in practice, to develop by frequent cultivations a shallow dry earth mulch or "blanket," using the harrow, weeder, and, later, the many-toothed cultivator.

The use of the roller upon a field of grain after the grain is well up gives excellent results in cases where the surface is lumpy and dry. The reason lies largely in the fact that in crushing the lumps a dry earth mulch is developed to lessen the evaporation, while the packing of the soil may have the effect of improving capillarity below.

To bring Moisture nearer the Surface.

It sometimes happens that because of the looseness of the soil water is not brought up sufficiently rapidly into the seed bed, or it may be that evaporation from the surface is so rapid that the moisture from below cannot move upward rapidly enough to balance these evaporation losses. The result in either case is an insufficient amount of moisture in the upper soil.

A well-developed mulch would reduce the evaporation losses, and since water moves more rapidly through moist soil than through dry, the tendency would be to accelerate the upward movement of moisture and in time to accumulate an abundance of it in the upper soil.

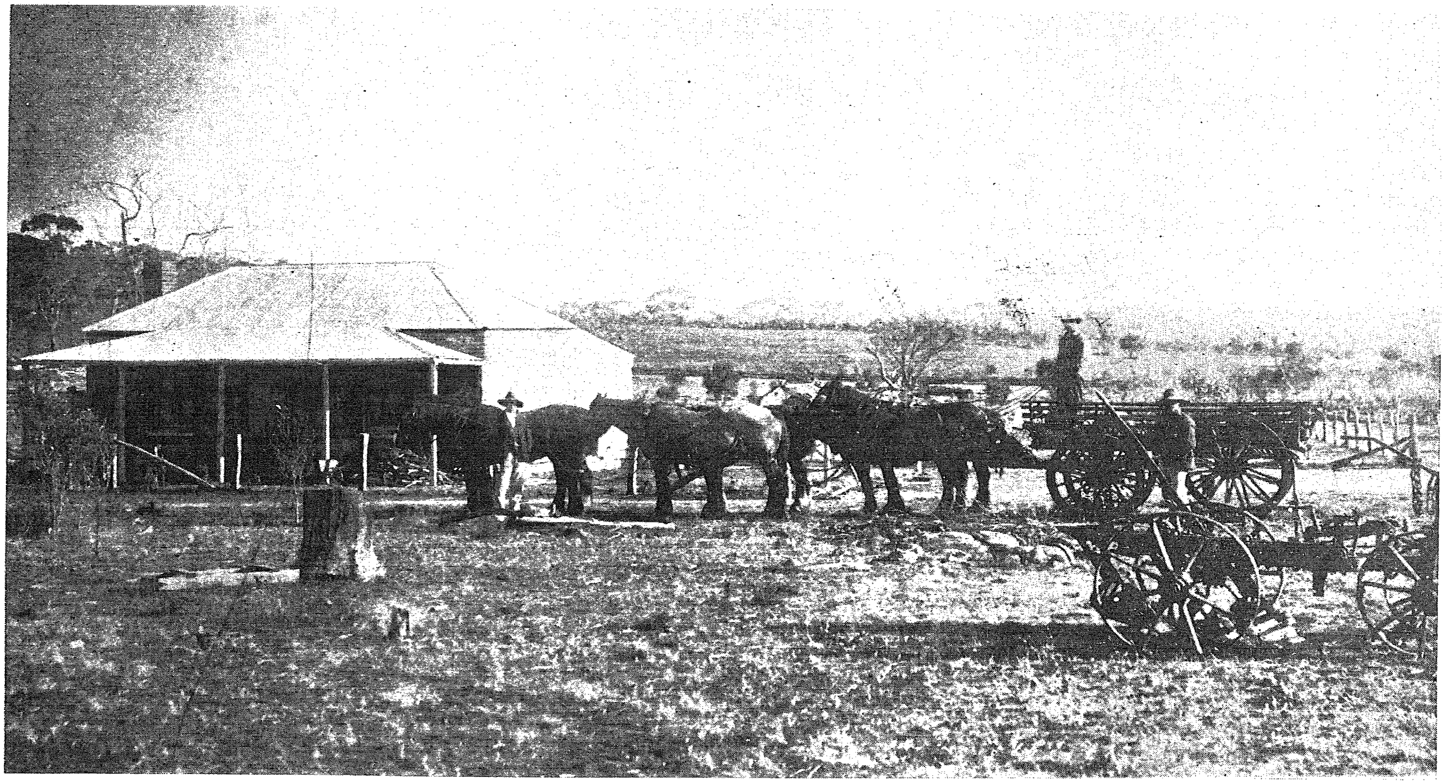
Rolling the land would compact the soil and thus increase the upward movement of moisture from below. The roller should be followed by some mellowing tool to develop a surface mulch and thus to lessen surface evaporation.

Had this soil received good dressings of manure, and the same been well incorporated in the soil, its presence would have had the effect both to gather moisture from below and to prevent its loss by evaporation.—*Exchange.*

MOST PROFITABLE HORSE TO BREED.

The question is so often asked—"What is the best and most profitable breed of horse to take up?" that a general reply may be given here. There is no most profitable horse in the accepted sense of the word "best," as almost every element of success, apart from a spirit of perseverance on the part of the breeder, depends upon the conditions under which he lives.

The question of soil, of climate, of space, and, to a lesser extent perhaps, of personal inclination, must all be taken into consideration before a stud can be expected to pay, for horses, though they may exist and even thrive under congenial conditions, require to be most carefully studied in the matters referred to above if it is desired to produce them and bring them to maturity at their very best.



NARROGIN.
MR. J. HOLLIS' FARM.

The business of a horse breeder is always more or less of a speculative character, so far as the production of animals of the very highest character is concerned, but, on the other hand, a persistent attachment to the orthodox rules of breeding is morally certain to bring its reward in the long run. By this it is meant that if the owner places the proper class of horse upon his land, exercises proper judgment in thinking out his crosses, and sticks to blood without being led away by outside influences, such as a win at a show, if he treats his animals properly and perseveres, he is very likely indeed to make his stud pay him well. Misfortune in the form of unexpected contingencies may cause a temporary check, but breeding must tell in the end, and therefore, if he determines to abjure reckless experiments in crossing and to stick to the best blood, a man should have full confidence in investing capital in horses.—*Australian Farm and Home.*

THE ART OF MILKING.

The fact cannot be too strongly or too frequently insisted upon that the milk yield of cows is increased by careful and kindly treatment at milking. Not only should there be kindness but intelligence, for we all know that the suckling of young is a function on the part of the dam that brings forth the kindliest of feelings. Therefore the part of the milker is to get the cow into that mental state as nearly as possible.

M. Lepoutre, Agricultural Engineer and Assistant to M. Roquet, Professor of Zootechny and Animal Physiology at the Agricultural Institute of Belgium, has just made a series of interesting and careful experiments at the laboratory of zootechny and hygiene of the institute for the purpose of determining the influence exerted by milking upon the quality of the milk, upon its composition, and particularly upon the proportion of its fatty materials. Although our knowledge as to the influence exerted by the nervous system upon the physiological tissues is very meagre, the experimenter started from the innervation (nervous stimulation) of the glands in general (to the greater or less excitation of which corresponds a more or less abundant secretion), in order to try to bring about an artificial excitation of the mammary innervation for the purpose of improving the lacteal secretion.

Broadly considered, the operation of milking is a rational massage that has the effect of drawing from the udder a quantity of milk much greater than that which is contained at the outset. It is admitted that the udder of a good cow may, before the operation, contain three quarts of milk already formed, while, if the animal is well treated, the udder may yield from ten to fifteen quarts. It follows, besides, from the experiments of M. Lepoutre, that milking exerts a great influence upon the proportion of the fatty

materials contained in the fluid. This influence is due, according to the experimenter, to the peripheric excitation of the nerves of secretion, which, in their turn, by reflex action, bring about a greater excitation of the glandular cells.

First Teats Richer.

If we consider the general case of milking from two teats at once, as usual, we find that the effect produced is not the same during the entire period of the milking. The milk extracted from the first two teats is generally richer in fat than that of the two milked in the last place, and this richness will be greater if we simultaneously milk one teat of one side and one of the other, and then the two remaining ones—in other words, if we do the milking diagonally instead of laterally. The phenomenon is singular, if not obscure. It seems, however, explainable by the fact that in diagonal milking the excitation extends to all of the nerves of the gland, while in lateral milking it extends only to the side on which the operation is performed, and is consequently stronger.

At all events, the influence of milking upon the proportion of fat is shown by the following experiment of M. Lepoutre:—

The same cow was milked several times and simultaneously by two different persons, who at each operation changed sides. The milk of each side was collected separately. One of the persons performed the operation by exerting a simple alternating pressure upon the teat, while the other performed a downward massage at the same time.

One Milker got Richer Milk.

The milk collected by the latter person was always markedly richer in fatty matter than that collected by the former.

The difference was considerable, since in the first case there was fifty-five per cent. of total yield, and in the second forty-five. The method of milking has, therefore, a great influence upon the quality of the milk, and this influence is not explainable unless we grant that it bears some relation to the excitation produced.

Last Milk Richer.

On the other hand, the milk obtained at the beginning of the operation is not so rich as that obtained at the end. Up to the present this fact has been explained by the statement that a prolonged operation ends by detaching from the lactiferous vessels the particles of butter adhering to the walls. M. Lepoutre is not of this opinion, and remarks that the operation is performed more vigorously at the end than at the beginning. The excitation must, therefore, be stronger, and the reflex action be greater upon the mammalary tissues, thus causing a lactiferous secretion richer in fat.

Practical Experience.

A South Australian farmer, giving his experience and views upon the subject in the *Garden and Field*, says:—

As a boy I was a good milker, and I cannot remember when I could not milk. For 20 odd years, however, I never touched a cow, but on trying one day, I found that one's hands go back naturally to the peculiar move-

ments required in milking; though the operation makes them ache most terribly until they get used to it. For some years I have milked the family cow occasionally. A few months since the cow seemed to be going off in an unusual way, and one evening when the lad was away I milked, and on taking the bucket in was met with the remark, "You've got more milk to-night." I weighed it, and the next morning I was told there was more cream. When the lad had finished milking the next morning I tried the cow and drew off more than a pint. I talked to him, and for some days the yield was better, but still I could always get a pint after him. I had to dismiss the boy, and have milked myself every morning since, and the report is that I get more milk and it is richer. I cannot say just how much better in each case; but there is a noticeable improvement.

The reading of M. Lepoutre's experiments seems to explain the matter. The cow's teats are rather small for my hands, and I cannot milk them very fast. One quarter of the udder is dry, and in milking I change about, usually milking with the whole right hand and with the thumb and finger only of the left. In the process the udder receives an unusual amount of massage, and as the cow is a pet there is little doubt but that my more gentle handling and a little fondling has also an influence. I think that the results recorded in the article quoted are worthy of the closest attention of Australian dairymen. Milking is not an unpleasant or irksome task, and I cannot understand the objection to it on the part of many farm hands, or on the part of girls. Of course, the surroundings of the milking shed should be made free from objectionable mud and dirt. Will anyone who has noticed any evidence bearing on this subject please send in a few notes for the mutual benefit of readers?

NOTES ON THE CHAPMAN EXPERIMENTAL FARM.

By R. C. Baird.

Since my last report we have completed planting the new vineyard. There are about two and a-half acres, containing all the varieties of the best table grapes, a number for raisins and currants, and a few wine grapes.

Lucerne seed was sown all over the "leg-of-mutton" paddock—about 14 acres. Another patch of 11 acres were also sown with grasses, as follows:—Sheep's Burnett, Festina Elatior, Poverty Bay Rye, Hungarian Forage grass, Danthonia Scunansinlaris, and Prairie grass. Six acres of sand-plain was prepared and sown with five different varieties of Salt Bush seeds; also small plots of grasses.

The rape crop is now carrying a good number of stock, which enables us to rest some of the pasture paddocks.

The pigs are also doing well on the rape which was specially sown for them in the new pig paddock.

The new Berkshire boar arrived safely during the month, and should prove an acquisition to our herd.

During the month the Shropshire lambs were marked, the percentage of lambs being 92.

Forty chains of fencing were erected by contract, and about 30 chains of fencing have been done by the students, in charge of one of the workmen.

The Upper Chapman ploughing match was held during the month. Students J. Rorhs and C. Chatham competed in the youths' class, and took first and second prizes respectively. Student Rorhs was also successful in securing two special prizes. W. Oxenham, farm ploughman, competed with the three disc plough, and scored a win.

There are now 11 students on the farm. The work they have to do is of a very varied character, and I am pleased to be able to report that they are taking a keen interest in the general routine of the farm work.

We are now busy sowing summer crops, the ploughing of fallow land, and the cultivation of the orchard and vineyard.

The past month has been characterised by unusually heavy rains for this district, 4·25 inches being recorded, most of which fell early in the month, extending over 13 days. Some of the crops on the low-lying ground were thrown back, but with the warmer weather that followed are now making good growth.

The crops generally are somewhat later than those of last year.

The season has been a good one for grass, and the stock are all in thriving condition.

The early varieties of wheat are well out in ear, and hay cutting will commence about the middle of next month. The oat crops are more backward, but with the warm weather we are now experiencing should make rapid growth.

The grasses sown in August are making fair headway, while the saltbush seeds sown at the same time appear slow in germinating.

Several varieties of sorghum and millets, also some maize, were sown during the month, but have not appeared above ground yet.

The potatoes planted in July are looking well. Those growing on land treated with 20 loads of farmyard manure per acre are making better growth than those on land treated with the "special potato manure" at the rate of 4 cwt. per acre.

The field peas are now making good growth. Cape weed grows very luxuriantly here, and we have had great trouble with it in the pea crop. Several varieties of garden peas were sown, and are doing fairly well.

In the vegetable garden we have a plentiful supply of cabbage, onions, lettuce, radishes, etc.

During the early part of the month, while the ground was soft, a number of dead trees in the house paddock were pulled down, horses being used to do the work. The trees are now being got rid of by burning.

The ewes and lambs are looking well, many of the crossbred lambs being fit for market. The shrop ewes have been much better this year than last, 100 per cent. of lambs were tailed from them; one lamb has died since.

The Angora goats have also done better this year than last. During the past month 16 kids were dropped.

The Suffolk stallion is in good condition, and doing a good season. A large number of mares are now at the farm for his services, and inquiries are still being made regarding fees, etc.

Shearing will commence at the beginning of next month, and when that work is completed hay cutting will be in full swing.

NOTES ON THE NARROGIN EXPERIMENTAL FARM.

By Frank L. Faulkner.

The past month has been a particularly favourable one for the district, the weather being much warmer, few frosts being registered, and although we had $4\frac{3}{4}$ inches of rain early in the month, crops and grass did not appear to take any harm from it. Land everywhere is now drier and in better condition for the crops than it has been since May.

Crops on the farm have made astonishing growth during the last few weeks, and promise to give fair results.

Grass is still scant enough for this period of the year, although on our country we cannot expect a good swarth until the land has been cleared and fertilised.

Stock are all in good condition. The sheep, rather more than any other stock, seem to do well and thrive on our poor scrubby country.

The goats are now kidding, and are looking well, and although the weather is still very unsettled they will require to be shorn very soon, or much of the hair will be lost.

Six cows in milk are keeping up a good flow of milk, and are in good order.

Horses are all in good working condition, but we have not had a great deal of work for them during the month.

Fallowing has been done on every available piece of land as soon as it became cleared or sufficiently dry, and we are still proceeding with it, summer crops and melons, pumpkins, etc., being sown as the land is made ready.

Clearing and suckering have taken up a good deal of the labour of the month, the former to be pushed on as much as possible until the season closes. With the wheat crops the experiments with manuring and varieties are now reaching a stage of interest, and for next month's report I hope to prepare a report of all the experiments, in detail, that will be of interest to readers. The grass and other plots are still hardly advanced enough to be interesting, but no doubt by the next issue of the *Journal* they will develop some interesting features.

Potatoes sown at the close of last month and early in the month are now showing above ground.

Trees and vines are bursting into leaf in the orchard and vineyard, and a number of the peaches and plums have flowered and set a few fruit.

An acre of cherry trees recently planted is bursting into bud nicely.

Vegetables are plentiful, although early sown peas and beans have been practically ruined by the late frosts, and even cabbages have been nipped in the heart.

For early winter vegetables, white stone and golden ball turnips did the best with us; and some very good purple-top swedes have been grown. I think, however, that even for stock-feeding purposes the early varieties of turnips or swedes will give us the best results.

The poultry are doing much better now that the cold wintry weather has stopped. We have a good number of chicks, turkeys, and geese hatched, and a number setting.

The pigs have given us considerable increase during the month, and are still helping us considerably with the meat supply. Having sold a great proportion of our grain as seed, we have already finished our own grown supply, but with turnips and rubbish from the vegetable garden we are able to keep them in condition, with a little pollard. I hope to have a fairly large number of young slips and weaners ready to turn out on the stubbles as soon as the harvesting is complete. I am also endeavouring to complete the fencing of two pig paddocks that have been sown to crops of peas and a mixture of vetches and wheat. These crops are coming on fairly well, and will shortly be ready for the pigs to graze on.

Law, Somner & Company.—Elsewhere in this issue will be found the advertisement of Messrs. Law, Somner & Co., the well-known seed and plant merchants. This firm has been established over half a century, and are well known for the excellant quality of all their seeds, plants, and trees. They supply everything for the farm, garden, and orchard, and of one quality only—the very best. [Adv.]

THE RELATION OF FOOD TO DAIRY PRODUCTION.

F. W. Woll.

(*Continued.*)

We note that the best cows needed only 89lbs. of dry matter for each 100lbs. of milk they produced, and 20lbs. for each pound of fat; while the cows with medium production needed 105 and 24 pounds, and the poorest cows required 125 and 28 pounds of dry matter for the production of units of milk and butter fat, respectively. The amounts of digestible protein and of total digestible matter consumed per unit of products will be seen to vary in a similar way. The cows producing the largest quantities of dairy products were, therefore, able to utilise their food to much better advantage than the cows that only produced medium or low amounts of milk and butter fat, the average difference between the two extreme groups amounting to about 40 per cent. in favour of the large producers.

In our University herd, on very nearly the same amount of food, one cow produced 475lbs. of butter fat and the other 262lbs. of butter fat for the year, and there was a difference in the average annual net profit returned by these cows over and above the cost of feed of 52·00 dollars. The best five cows in the herd during the period 1898-1903 ate 44·36 dollars' worth of feed, produced on the average 418 pounds of butter fat for the year, and yielded a net profit of 64·26 dollars. The corresponding figures for the poorest five cows, all of which were supposed to be fairly good dairy cows until their accounts were figured out, were: cost of feed, 31·27 dollars, butter fat produced 203lbs., net profit 21·30 dollars—an increase in the feed cost of the former cows of 13·09 dollars brought an increase in the production of butter fat of 215 pounds, and in the net profit returned by the cows of 42·96 dollars; *i.e.*, more than doubled the production of fat and trebled the net profit. The heavier expense for feed in case of good cows will pay a large dividend.

A similar difference in the value of two dairy cows was found in the herd of the Illinois Experiment Station. One cow produced, on the average for the year, 31·1 pounds of milk and 1·54 pounds of fat per day, the other —a moderate producer—21·1 pounds of milk and ·81 pound of fat. The ration fed the latter cow was only slightly smaller than that which the former cow received. One cow, therefore, required about 50 per cent. more dry matter and digestible nutrients than the other for the production of 100 pounds of milk, and nearly 90 per cent. more for the production of a pound of butter fat. The former cow produced 139 pounds of milk and 80·7 pounds of fat for every 100 pounds of milk or fat produced by the latter cow on the same feed and with no more body gain.

Body Weight and Production.—Body weight is doubtless, in general, an important factor in the economic utilisation of food for the production of milk and butter fat by dairy cows. We find that the amount of milk produced

is, broadly speaking, likely to be larger, the heavier the cows are, while the quality of the milk produced is, as a rule, in inverse proportion to the weight of the cows. There are many exceptions to this general relation, but we cannot ordinarily expect to have small cows give large quantities of milk, or to find large cows giving very rich milk. As regards the production of butter fat, no such general rule can be laid down, since large producers are found among cows of medium size as well as among heavy cows. The tendency is, however, toward a larger production of butter fat with an increase in the weight of the cows. Considering the production per 1,000 pounds live weight it will be found that light cows produce more milk and butter fat than heavier ones and also eat more feed, but the cost of food required for the production of a unit of milk and butter fat decreases with increasing weight of the cows, so that cows of good size may, in general, be looked upon as the most economical producers.

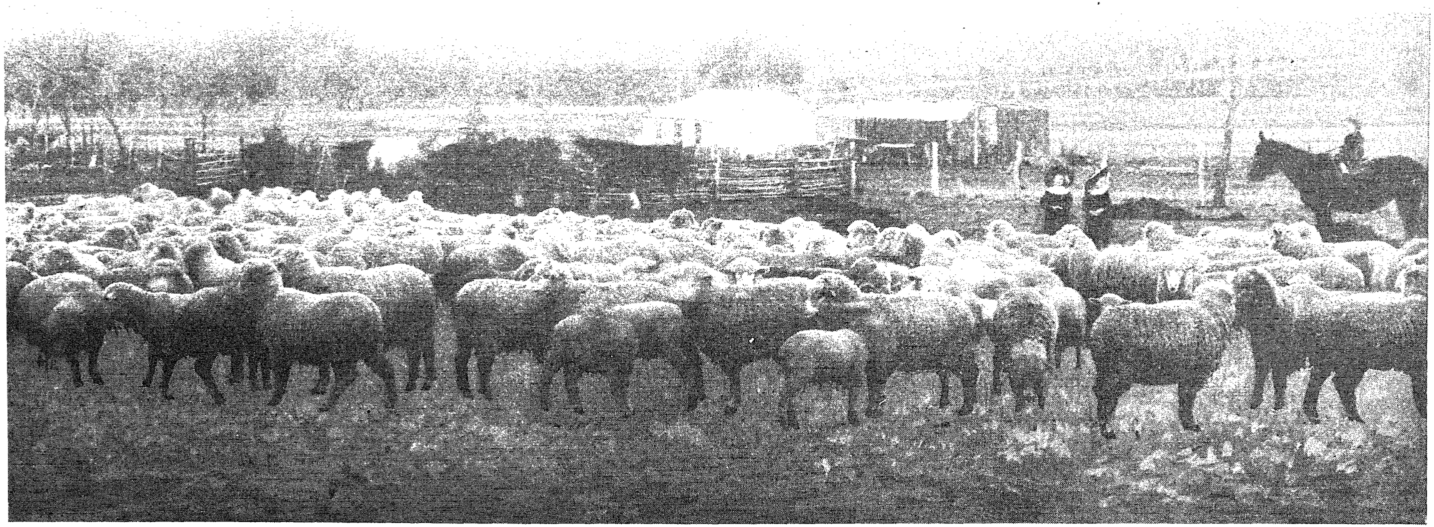
(b.) The Effect of Quality of Milk on Food requirements.

One hundred pounds of five per cent. milk will contain at least 14 pounds of total solids, while the same quantity of three per cent. milk will contain 12 pounds of solids or less. It is evident, therefore, that it will take a larger amount of valuable food materials to produce a unit of milk of the former than of the latter kind. A study of the relation between the nutrients required for the production of milk of different fat contents in the case of cows in our University herd showed that for every per cent. of increase in the fat content of the milk there was an increase of about eight pounds in the amount of dry matter required for the production of one hundred pounds of milk, and of about ·8 pound in the amount of digestible protein for the same amount of milk. Cows giving rich milk are, on the other hand, somewhat more economical producers of butter fat than those yielding milk low in fat, since the production of fat in case of these cows is accompanied by relatively smaller amounts of non-fatty solids.

(c.) The Effect of Period of Lactation.

It is well known that the maximum production of milk by cows comes from one to four weeks after calving, varying with different cows and with the system of feeding practised. Normally the maximum production of milk in a dairy herd will come at about the third week after calving and the maximum production of butter fat during the second week. The per cent. of fat in the milk is in the majority of cases higher during the first and second weeks after calving than at any other time during the period of lactation until toward its close, when the flow of milk has been greatly diminished. The natural falling-off in the flow of milk during the lactation period in a modern dairy has been found by various observers to be about eight per cent. per month and the decrease in the production of fat about seven per cent. per month. During the last couple of months of the period a somewhat more rapid falling-off takes place.

When we consider the feed consumption during the progress of the lactation period we find that this does not decrease to any marked extent even if the cow is not in calf; it is true, less or no grain is fed when cows are being dried off, but the total amount of dry matter eaten is but slightly lower than at an earlier stage of the period, hence the most economical production takes place at the early part of the lactation period. In experiments at the Geneva Experiment Station there was an increase in the dry matter



EAST NARROGIN.

MR. J. K. MCCRACKAN'S FARM.

required for the production of a unit of milk and butter fat between the first and the tenth months of the lactation period in the ratio of about 100 : 300, *i.e.*, it took nearly three times as much food toward the end of the lactation period as at its beginning for the production of a certain quantity of milk or milk solids.

(*d.*) The Influence of Age of Cows on Economy of Production.

The production of milk and butter fat by dairy cows under normal conditions increases with each year up to the fifth or sixth year, when the cow is at her best. The length of time she will maintain her maximum production depends on her constitutional strength and the care with which she is fed and handled. A good dairy cow should not show any marked falling-off until after ten years of age; many excellent records have been made by cows older than this. The quality of the milk produced by heifers is somewhat better than that of milk of older cows, for we find a decrease of ·1 to ·2 of one per cent. in the average fat content for each year till the cows have reached full age. It is possible that this is caused by the increase in the weight of the cows with advancing age; at any rate there appears to be a parallelism between the two sets of figures for the same cows.

Young animals use a portion of their food for the formation of body tissue and it is to be expected, therefore, that heifers will require a larger proportion of nutrients for the production of a unit of milk or butter fat than do older cows. After a certain age has been reached, on the average at about seven years of age, the food required for the production of a unit of milk or butter fat again increases both as regards dry matter and the digestible components of the food. A good milch cow of exceptional strength kept under favourable conditions, whose digestive system has not been impaired by overfeeding or crowding for high records, should continue to be a profitable producer till her twelfth year, although the economy of her production is apt to be somewhat reduced before this age is reached.

(*e.*) The Effect of the Amount and the Character of the Feed Ration.

The ration is of importance in dairy production both as regards its amount and character. Most dairy farmers know that good milch cows are large eaters and consume both considerable roughage and grain feed ("concentrates"). The extra feed eaten by such cows will, as we have seen, yield a good profit. It is, however, possible to feed too heavily; a marked increase in weight in the case of mature cows is always to be guarded against as it will be obtained at the expense of milk production, but even where the weight of a cow remains about stationary when in full flow of milk, there may be a danger of injuring her future usefulness by too heavy feeding. Experiments at this and other stations have shown that about six pounds of grain feed per day produces more economical results than larger amounts, and is sufficient in the case of most cows to secure a maximum production of milk and butter fat when the economy of the production is also considered, provided a supply of good roughage, hay, cornstalks, silage or roots, is available. Large producers can use more grain than this to advantage and may receive as much as ten to twelve pounds a day when at their highest production, but only cows of exceptional productive capacity and constitutional strength can give economical returns under such heavy feeding, and not much more than half this amount can be recommended as a general average for a whole herd of dairy cows.

Succulent feeds have an especially favourable influence on the milk secretion, and, whenever possible, either silage or roots should be provided for the winter feeding. The general adoption of the silo in the dairy districts of our country, where corn can be grown to advantage, furnishes strong testimony to the advantage of the siloing system to the dairy farmer. Thousands of farmers feel that the silo is an essential part of the equipment of a modern dairy farm. Under ordinary conditions, in the north central States at least, the corn crop can be fed more economically to dairy cows, and with much greater convenience, as silage than as dry fodder. The losses of valuable food materials in a modern silo are considerably smaller than in the ordinary field-curing of fodder corn, and the succulent aromatic silage has an excellent effect on the milk secretion of the cow.

Influence of Food on the Fat content of the Milk.—Numerous experiments have been made in the study of the influence of food on the fat content of milk, and volumes have been written on this subject during the last fifty years. In many cases experiments that have been published and discussed cannot, however, in view of our present knowledge, be considered of such a character as to justify some of the conclusions that have been drawn from them. It has been held, and doubtless with good reason, that the food has only a secondary influence on the quality (*i.e.* the richness) of the milk produced by cows, provided these are fed sufficient food to maintain their body weights while in milk. A cow that normally produces 3 per cent. milk cannot be made to give milk containing 4 per cent. of fat or more by any special system of feeding that we know of, nor can the proportion of fat in the milk to the other milk solids be changed at will by the food. The quality of the milk produced by a cow is determined by her inbred characteristics and cannot be changed to any large extent by feeding special foods or by changing the system of feeding. At the same time the evidence accumulated during late years shows quite conclusively that feeding stuffs of a nitrogenous character, like oil meals of the various kinds, gluten meal, malt sprouts, etc., have a beneficial influence on the quality of the milk produced by the cows, and that, in general, the best quality and also the largest quantity of milk which a cow is capable of producing will be obtained by feeding rations fairly rich in protein. As this is a most important result and of interest to all dairymen, we shall consider more in detail some of the experimental evidence that has led to this conclusion, and especially the experiments on this point conducted during late years at our Station.

The results of the feeding experiments conducted by the writer and associates at this Experiment Station since the establishment of the present herd, have been published in bulletin No. 102 and in our 21st annual report. During the first four and one-half years of these experiments the rations fed to the cows in our herd were of a rather wide nutritive ratio, *i.e.*, they contained only comparatively small proportions of protein. On such rations our cows were able to produce, on the average for the whole herd, 7,340lbs. of milk and 307lbs. of butter fat per year per head, equivalent to more than a pound of butter for every day in the year. Twenty-two out of the thirty-eight cows in the herd produced more than 300lbs. of butter fat per year, on the average, and 25 cows yielded a profit of 40·00 dols. or more per year over and above the cost of the food eaten. Bearing in mind the fact that fourteen of the cows were either two or three-year-olds when placed in the herd, it will be readily granted that this is a most satisfactory showing. The exact composition of the rations fed could only be determined during the

winter months since the cows were pastured in summer. The average rations fed during the winter for the period 1898-1903, contained 23·7lbs. of dry matter, 1·85lbs. digestible protein, and 14·1lbs. digestible carbohydrates and fat, and had therefore a nutritive ratio of 1 : 7·6. Since the approved physiological feeding standards for dairy cows recommend 2½lbs. of digestible protein and a nutritive ratio of 1 : 5·4 or 5·7, it might be argued, as was actually the case when our results were published, that the production of the cows in our herd would have been still higher than it was if the system of feeding followed had adhered more closely to the standards which are held up before us as the ideal theoretically.

To meet this criticism, it was decided to change the system of feeding of our cows during the past year, so that more nitrogenous rations should be fed than in previous seasons. The rations fed during the past year contained, on the average, ·34 of a pound more digestible protein than in the preceding winter periods, and the nutritive ratio of the average ration was 1 : 6·0. This was obtained by feeding most of the time a grain mixture of a very narrow nutritive ratio, viz., 1 : 2·4, made up of wheat, bran, distillers' grains, and cotton seed meal in the proportions of 2 : 2 : 1 by weight, with roughage as before, consisting of hay and corn silage. The rations fed to the herd contained, on the average, 22·7lbs. dry matter, 2·19lbs. of digestible protein, and 13·2lbs. of carbohydrates and fat. The cows produced, on the average, for the winter period, 20·6lbs. milk daily per head and ·91lbs. of butter fat, and increased, on the average, 47lbs. per head in weight during this period.

Since some cows were disposed of at the beginning of the period and several others were added to the herd, these yields are not directly comparable with those obtained during the preceding winter period, and cannot be used in studying the specific influence of the more nitrogenous rations fed last winter on the production of the cows. In order to obtain data for such a comparison it is necessary to include only cows that were in the herd during both seasons. Data for 14 cows in all are available for such a comparison. The results as regards the average quality of milk produced by the different cows are given in the following table, which also shows the average live

Comparison of Rations Fed and Production, 1902-3 and 1903-4.

No.	Name of Cows.	Live Weight.		Dry Matter.		Dig. Protein.		Nutr. Ratio.		Milk Per Day.		Fat Per Day.		Per Cent. Fat.		Increase.
		1902-3.	1903-4.	1902-3.	1903-4.	1902-3.	1903-4.	1902-3.	1903-4.	1902-3.	1903-4.	1902-3.	1903-4.	1902-3.	1903-4.	1903-4.
		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	1 :	1 :	lbs.	lbs.	bs.	lbs.			P.ct.
1	Maud	1,209	1,188	24·07	25·49	2·00	2·22	7·0	6·6	20·9	21·9	·77	·95	3·62	4·34	·74
2	Muriel	821	936	16·95	18·87	1·30	1·31	7·6	8·4	10·6	12·4	·66	·77	6·19	6·21	·02
3	Dorine	857	1,022	17·12	19·02	1·35	1·61	7·4	6·9	11·5	11·7	·61	·70	5·34	5·98	·64
4	Lady	1,147	1,169	31·94	26·95	2·91	2·68	6·8	5·7	39·9	36·7	1·63	1·56	4·08	4·25	·17
5	June	1,045	1,259	20·97	24·39	1·56	2·23	8·0	6·4	19·7	17·6	·74	·67	3·75	3·81	·06
6	Brownie	1,036	1,037	20·50	21·63	1·61	2·24	7·6	5·7	15·1	21·9	·81	1·28	5·33	5·84	·51
7	Joe	1,040	1,107	27·78	26·05	2·56	2·94	6·2	5·3	38·9	41·3	1·33	1·47	3·42	3·56	·14
8	Laura	913	955	22·70	22·98	1·99	2·16	6·8	6·0	18·3	16·1	·97	·83	5·30	5·16	·14†
9	McGeoch	1,203	1,355	21·92	23·93	1·76	2·19	7·4	6·3	22·6	13·7	·84	·54	3·68	3·94	·26
10	Donation	1,248	1,301	23·46	23·10	1·93	2·36	7·4	5·7	28·3	28·0	1·02	1·04	3·60	3·71	·11
11	Campbell	1,225	1,211	21·47	20·77	1·60	1·65	8·0	7·4	6·4	14·5	·25	·61	3·92	4·21	·29
12	Reba	912	969	17·02	19·18	1·17	1·60	8·6	7·0	12·0	11·2	·61	·65	5·08	5·80	·72
13	Bessie	873	1,032	21·86	18·02	2·09	1·33	6·2	7·5	26·1	10·7	1·18	·57	4·50	5·32	·82
14	Alma	1,001	1,083	25·71	21·96	2·21	2·23	7·1	5·8	37·6	34·7	1·17	1·07	3·10	3·09	·01†
	Averages ...	1,038	1,116	22·39	22·31	1·86	2·05	7·3*	6·5*	22·0	20·9	·90	·91	4·35	4·66	·31
	Averages (excl. of No. 2 & 13) ...	1,070	1,137	22·89	22·95	1·89	2·18	7·0*	6·2*	22·6	22·4	·90	·95	4·18	4·47	·29

* Arithmetical means; av. dig. carbh. and fat + dig. prot. for herd was 1 : 7·1 and 1 : 6·3 (excl. No. 2 and 13, 1 : 7·2 and 1 : 6·1). † Decrease.

weights of the cows during the two periods considered, November 12, 1902, to May 13, 1903, and November 18, 1903, to May 18, 1904, the dry matter and digestible protein in the average rations fed, the nutritive ratios of these rations, and the average production of milk and butter fat for each day of the two periods considered.

Since in the case of two cows the nutritive ratios fed during 1903-1904 were wider than those fed during the previous season, the average data for all cows but these two have also been calculated and are given in the last line of the table.

The main interest centres in the figures in the last column of the table, which show the increase in the average per cent. of fat in the milk produced by the cows during the winter period 1903-04 over the corresponding figures for the preceding period. We note that there is a uniform increase in the average fat content of the milk produced by all the cows but one on the narrower ratio fed last winter, if we consider the per cent. of fat in Alma's milk the same for both years, as is practically the case. In the case of four cows this increase exceeds one-half of one per cent., and on the average for the 12 cows it amounted to ·29 per cent. in favour of the narrower ratios. This improvement in the average quality of the milk was accompanied by an increase in the weight of the cows amounting to 67 pounds per head, on the average, and by a falling off in milk yield of ·2 pound, so that the total production of butter fat was also increased, viz., by ·05 pound per head per day. While this may seem too small to some to be worth mentioning, it is equivalent to one pound a day for a herd of 20 cows, or 300 pounds of butter fat for the year for such a herd.

It is not claimed that these results furnish conclusive evidence on the question of the influence of fairly nitrogenous rations on the production of the cows, as compared with wider ratios, because the cows were not kept under directly comparable conditions in all respects during the two periods considered. The influence of differences in the age and live weights of the cows the two seasons, as well as the uneven milking periods of some of the cows, should be considered in interpreting the results; it may be said, however, that on the whole, the points of differences are such as would tend to affect the fat content of the milk in the opposite direction to that noted, and we feel warranted, therefore, in taking the results on their face value and concluding that the teachings of these are what they appear to be.

RATIONS FOR DAIRY COWS.

The kind of rations that will give the best results in feeding dairy cows will vary considerably according to the conditions under which the farmer is working, as has already been explained. We have examined the main principles that govern the production of milk and butter fat by dairy cows and have seen that their food requirements vary greatly, and that some cows will utilise for dairy production the food which they consume with much greater economy than others. The chief aim of the dairy farmer should therefore be to ascertain, at least with a fair degree of accuracy, the yield and the quality of the milk produced by the various cows in the herd and the amount of food which they need for this production, especially concentrates, since these for the most part represent cash outlay. If prices of protein foods, like oil meal, gluten meal, distillers' or brewers' grains, cotton seed meal, are not too high in proportion to the more starchy foods, mill refuse

feeds, hominy feeds, small grains, etc., it will be profitable to feed such amounts of these as will bring the nutritive ratio of the rations fed down toward 1 : 6. As we have seen, it is only in the case of large producers or relatively cheap protein foods, that more than about two pounds of digestible protein per head daily, or rations of a narrower nutritive ratio than given, can be fed to advantage.

During the past winter period the cows in the University herd were fed with rations containing from 1·31 to 3·55 pounds of digestible protein and having a nutritive ratio of 1 : 4·8 to 8·4. The special rations fed to these cows were determined by the individual performance and characteristics of each cow, the object in view being to feed as much roughage as the cows would eat up clean, with as much grain feed as was necessary in each case for a large production of milk, without at the same time causing a material increase in the weight of the cows. We believe this is the correct system of feeding dairy cows, and from the results obtained here and elsewhere where this system has been followed, we can recommend it to all dairy farmers. This system of individual feeding renders the matter of nutritive ratios and prescribed rations of only secondary importance, since it must be left largely to the cow herself to determine how a maximum economical production may be obtained in each case. It is, therefore, not only useless, but decidedly a wrong system to prescribe certain rigid standards of feed rations for all cows, even when the quantity of milk produced is considered in the construction of these standards. Dairy farmers should familiarise themselves with the chemical composition of available feeding stuffs and the market prices of these, and should strive to know the characteristics of each cow in the herd so that the system of feeding practised in individual cases may be such as will secure, at a fair cost, the largest dairy production of which the cows are capable. Economy of production should not, however, be a prime consideration, since the ideal dairy cow in that case would be one consuming a minimum amount of food: such a cow would be likely to produce also a minimum amount of milk and butter fat. The ideal dairy cow is one that will produce large quantities of milk and butter fat economically and will continue this production during her entire life in the herd. The continued usefulness of the individual members of the herd is of importance to the dairy farmer and should be kept in view, rather than a maximum production for a single lactation period or a portion of the same. We trust that the discussions and suggestions offered in the preceding pages will be of some assistance to farmers who are dependent to a greater or less extent on the production of their cows for a living, and will enable them to understand more clearly than before the relation of food to dairy production and the principles governing the successful management of a dairy herd, in so far as the supply of feed is concerned.

IS CHEESE INDIGESTIBLE?

"What to do with Cheese.—Those who insist upon eating cheese should take the precaution to cook it thoroughly before eating. It is for this reason that some people who are unable to eat raw cheese find themselves able to eat toasted cheese without difficulty. Toasting the cheese does not, however, increase its digestibility, but rather the reverse. Its beneficial effect, if any, is from the destruction of the virulent microbes which are present, and which are capable of giving rise to symptoms even more distressing than those of ordinary indigestion. The best method of dealing with cheese is to give it to the pigs, as it is nothing more or less than decayed milk, and is fit only for a scavenger diet."

The foregoing quotation, says a writer in the *Agricultural Gazette*, is copied from a journal professing to be the organ of a scientific body which is not concerned with dairying, except incidentally and to a very small extent. It was written apparently—nay, obviously, by somebody whom cheese does not agree with, and who had, perhaps inadvertently, swallowed some of it in a form more or less disguised. It is no doubt true that a person here and there may be found—possibly one in a thousand—who cannot eat cheese without incurring discomfort in the interior. Cheese, we may venture to assume, is not the only article of food that disagrees with the digestive apparatus of such persons. The quotation at the head of this article may be accepted as evidence of the existence of certain unfortunate persons who, unable to use one of intrinsically the best of foods from a nutritive point of view, if not indeed the very best that can be named, and one of practically the cheapest from a financial standpoint, are fain to fall foul of what—to their solace and profit—other people greatly enjoy. This sort of thing is not at all uncommon in the best of all possible worlds.

Were this subject of masculine dyspepsia—assuming it to be masculine only—investigated up to a proof point in respect to cheese, we should more than probably find that cheese is "more sinned against than sinning"; else how can we account for the fact that ninety-and-nine men and women and even children eat cheese not with impunity only, but with satisfaction—and even thrive upon it as well, to say the least, as upon any other article of food than we can name? It may be said with confidence that no equally simple and familiar diet will sustain a man as cheese will through severe and prolonged physical exertion, and it is no less cogent and pertinent to say that no equally concentrated food is equally easy of digestion in any normal human stomach. If a man suffers from insomnia—or a woman either, for that matter—let him or her give a fair trial to bread and cheese for supper. Personally, I am prepared to abide by the verdict, if it be fairly arrived at. Cheese—ripe cheese—is readily digestible. It is a kind of food which is calculated to allay half, or more than half, the insomnia our flesh is heir to.

Why Cheese is easily Digestible.

And the reason why cheese is an easily digestible food, and why as a result it is conducive to sound and healthy sleep—why, in short, it is one of

the most popular and ancient of articles of diet prepared artfully by hand—is not far to seek. The coagulation of milk in cheese-making, be it remembered, is brought about by a fluid called rennet, in which the active ferment is pepsin. Rennet, so-called, is obtained from the glandular portion of a young calf's stomach, which has been suitably prepared, and contains the ferment which enables a young calf to digest the milk of the cow, which for some days forms the only food the calf can assimilate. The milk is coagulated in the calf's stomach in a manner corresponding to coagulation in the cheese-tub, and by the same ferment, viz., pepsin, though at a somewhat lower temperature (80deg. F., as against 98deg. F.) and not in so short a time. The process of making cheese from milk is digestion slowed down somewhat until coagulation is completed and the whey has been removed, after which it is still more obviously retarded until, at work in the pressed cheese slowly ripening on the floor, the pepsin ripens the cheese in course of time.

How is Cheese Ripened?

The coagulation of milk and the ripening of cheese—all one continuous process—is analogous to the digestion of milk in the stomach of a calf, or of a child, or of any other young living thing of the order mammalia, though occupying months instead of hours; and in each case the work is carried on by the ferment called pepsin, though the work is retarded in cheese-making by a much lower temperature than that to which milk is subjected in the stomach of the young animals indicated above—that is to say, it is the pepsin that ripens the cheese. Here we have the whole thing in plain terms, not loaded with technicalities or with scientific explanations, in a manner easily to be "understanded of the people." This indeed it is that explains the why and wherefore of cheese having for centuries been generally eaten after dinner, viz., because the pepsin it contains assists in digesting the rest of the dinner. This explains, too, the marvellous intuition of our greatest of all dramatists where, lamenting, he says: "Why, *my cheese, my digestion*, why hast thou not served thyself in to my table so many meals?" Here is a scientific truth actually divined by the genius of Shakespeare.

Should Cheese be Toasted?

"Those who insist upon eating cheese should take the precaution of cooking it thoroughly before eating." I sit amazed at the colossal assurance of this statement by the scribe whose paragraph is placed as a text for this article. The statement goes to show that a little knowledge is a dangerous thing. "Thoroughly cooking!" Why, this is the very thing of all others that would most effectually make cheese hard to digest. The "cooking," if thorough, dissipates or destroys the pepsin, which has been slowly increasing in quantity as the cheese ripened. To thoroughly cook cheese would be to injure and not to improve it as an article of diet, and in this case indigestion would be all the more likely to occur. But what does our wise expert mean by thoroughly cooking? Does he mean toasting, simply, or what? He makes the somewhat rash statement "that some people who are unable to eat raw cheese find themselves able to eat toasted cheese without difficulty." It would be interesting to learn where the information comes from on which this problematic statement is based.

The solitary bit of common sense in the paragraph immediately follows the last quotation, viz., "Toasting the cheese does not, however, increase its digestibility, but rather the reverse!" Well, we should imagine it did,

even if the writer had said not a word about it. But why toast the cheese at all? Listen to what he has said:—"Its beneficial effect, if any, is from the destruction of all the virulent microbes that are present." I will ask now if our scribe does not merit some sort of commiseration? Since it would appear that when he wrote he was suffering from an attack of dyspepsia more than usually severe, we may therefore dismiss the statement as the phantasy of a mind warped by a stomach in a state of rebellion.

Well, we have to listen to all sorts of absurdities as we go through this vale of tears, and we reach a climax in the last sentence of the paragraph. Here we have most obviously a hater of cheese who sets Shakespeare on one side as if of no account. To take such a wild lucubration seriously is out of the question after that. One cannot feel that such writing will do the reputation of cheese any harm. And, after all, a denunciation such as that I have been writing about is only another "Green tea is poisonous." The paragraph will have been read with mingled feelings, in which credulity will be conspicuously absent. This at least will be the case with people who know anything worth knowing on the subject.

To finish, I may venture to say that toasted cheese, if nicely done, is very appetising, and not at all indigestible by an ordinary stomach. But there are more ways than one of toasting cheese—thorough cooking, to wit. Cheese slowly toasted—melted rather than toasted—and served up with macaroni (the two toasted together by preference) is a dish to set before a king! Be it remembered that an old, mellow, thoroughly ripe cheese is easier of digestion than half the cookeries we devour, and that the same cheese toasted would be less easy of digestion. But who would ever dream of toasting a grand old, blue-veined, mellow, toothsome Cheshire, such as were once not uncommon, but are now hard to find?

ARTIFICIAL FEEDING.

Possibilities in Lamb-raising.

(By a Special Correspondent to the *Adelaide Observer*.)

A new order of things is dawning for the lamb breeder. The demand for good lambs is proving a strong one, at prices which will pay the grazier and farmer to make every provision to insure a good weighty carcase. In the past breeders have not hesitated to artificially feed their stud sheep, as they could not afford to lose valuable animals; but because sheep have been raised so easily and so cheaply it was never considered worth while to buy hay to feed ewes and lambs that might only be worth one shilling per head as ordinary station flocks. Now, however, there is a big demand for every lamb we can grow, and owners have been encouraged to make every effort through this last lambing season to save their ewes and offspring.

WEST NARROGIN.

Clayton and Rintoul's Farm A fine lot of Cross-breds.

In many parts of the State pastoralists have been experimenting with various sorts of fodders. The results have varied, yet everywhere it has been shown that when we know how to feed our ewes properly, even as we know how to feed brood mares and milch cows, the results will be far reaching. It means that we are to have a new market for our hay and general produce from cereal crops, and that the finest one in the world—a home market.

The methods of feeding have been different, and in every case experimental. That usually adopted has been the simple but wasteful plan of carting loose hay into the paddocking, and scattering it broadcast for the ewes to pick up. It is astonishing how quickly even station sheep will learn to follow the hay cart. After only a few days' feeding they will bleat and pursue the cart in their eagerness to pick off the wheaty heads. The result is that much of the long hay is trodden under foot and left to waste.

So to make the sheep appreciate the straw, one grazier soaked the hay well with molasses and water, using one part molasses to ten of water. The ewes took to it greedily, and wherever the pure molasses were spilled, they licked it up with evident relish. But the concoction seems too strong, as it badly scoured many of them. Chaff and bran appear to have been the greatest success. One sheep in fair condition will live and do well on 10lb. of chaff per week and 1lb. of bran.

Putting chaff at £2 per ton, and bran at 8d. per bushel, it will cost just about 2½d. per sheep per week to feed a good lambing ewe. Now, the most dangerous time for ewes in our northern areas is March, April, and May. Nearly every year there is abundance of good, nutty, dry grass, and serviceable stubble until the end of February, and usually all farmers' stock are in good condition in that month. In the next two months there is a remarkable change. Sometimes we have a heavy March rain, which grows very little if any new feed, and takes all the goodness out of the old feed.

Then again graziers do not carry as many sheep as they might in September and October, when they fatten up an extra mob of wethers for February markets, which are usually good markets, because they want to save a big lot of feed for March and April. Let that grazier or farmer put 50 to 100 tons of good hay in his sheep paddock somewhere handy to the water and near a few shady trees, and what a pleasant experience he will have at lambing time, instead of the general worry and anxiety.

He will get a good price for his hay in a sure cash market—that is, at £2 per ton. He will be able to confine his ewes to one or two paddocks for three months—say the scrubby paddock where the water and hay are, and one good stubble paddock which he has saved for the purpose. This will give all the rest of the farm a splendid chance to benefit by the early rains; so that when his careless neighbour has his poor ewes and helpless lambs licking up the barely green earth in June, he will be able to turn out his good-conditioned ewes with a big percentage of sturdy lambs to a good area of well-grown feed.

It stands to reason that sheep running on the early growing green stuff must eat up an immense amount of good fodder. When, say a sturdy geranium or dandelion plant is an inch high, an old ewe comes along and nips it off, and so annihilates what in two months' time would be a wide spreading plant, at which the old ewe could many times "cut and come

again." More important still, that careful breeder has all his flock under his eye, where he sees them at least twice every day.

How many scores of lambing ewes die every day in the gutters and lonely places of the farm simply for want of five minutes' kindly attention ? Only this season I saw a beautiful young ewe lying in a hollow unable to rise, with a pretty, bleating lamb beside her, and those hideous creatures of prey, the crows, cawing beside their promised meal. And only for want of a friendly lift ! Imagine it, breeders—a golden sovereign lying in the paddock and no one to pick it up ! I felt so keenly the sorrow of a bushman that I got out at the next station and telegraphed the owner to come and pick up his own sovereign.

All this will cost say 3s. per head for three months, and what is to pay for such expense ? Why, instead of raising as we now do an average of 70 per cent. of lambs, we will raise 90 per cent. at 10s. per lamb, which is a fair average price—£10 per hundred ewes, or 2s. per head on the flock. Instead of losing as at present five per cent. of our lambing ewes, we will not lose more than two per cent. In other words, we shall save three per cent., or quite £3, or 6d. per head.

Again, the best growing weather for the wool, and also the time of the year when the wool usually suffers most, is March, April, and May. Therefore, by keeping the ewe in good order, instead of allowing her to waste away to a shadow, she will easily produce an extra shilling's worth of wool. That makes 3s. 6d. per sheep, or the whole cost, including labour refunded, with the additional big advantage that three parts of the farm will, during the early growing months, be nursed so that the breeder will be able to carry at least 50 per cent. more sheep, and make lamb-raising a surer and safer business, besides rearing a better class of lamb and producing cleaner and more valuable wool.

One of the best and cheapest methods of feeding with chaff is to make a hessian or bag trough by putting two strainers 2 feet apart at each end, with 60 yards between, and fill in with T iron posts every 10 feet and 2 feet apart, so that it makes a double fence 50 yards long with 2 feet feeding space between. Drive the iron posts into the ground until the middle hole is 15 inches above the surface, then run two wires into each of the double fences. The bottom wire, being 15 inches above ground, will form the top of the trough, and the one above will keep sheep from jumping into the trough. Now sew 36 inch wide hessian on to the bottom wire on either side, and you will have a very serviceable trough to feed 300 sheep at a time.

To induce the sheep to take to the trough feed, mix a liberal allowance of bran with a bag of chaff, and spread about in little heaps on the hard ground. The sheep will soon get a liking for it, and by gradually putting the heaps closer to the trough they will quickly take to the regular feeding. Even wild station sheep will learn to run after the chaff bag.

Professor Angus strongly advises summer fodders such as kail, rape, and sorghum or lucerne for lambing ewes, but warns the farmer against having the ewe too fat just before lambing. This, however, is a warning little needed in our dry northern areas, where we rarely see any rain for four hot summer months. Many farmers have tried such crops with very poor

results; although in a few favoured spots small lots of lucerne are getting a good hold and are proving invaluable. No doubt with experience we shall soon grow a great deal more lucerne; but it has often struck the writer as remarkable that farmers do not drill into their stubble land some time in February seed, and say 50lb. of fertiliser, for the sake of early feed.

A farmer and breeder at Undalya last year drilled into 40 acres of fallow Majestic wheat and 56lb. of superphosphate per acre before the first rains. It came up, of course, very dirty, but he kept on that 40 acres for four months, with the aid of a little grass land, 120 ewes and their lambs, removed them in August, and cut over a ton of hay to the acre in October. This year, in February, he drilled half a bushel of Majestic wheat, with 56lb. of superphosphate per acre, into 30 acres of stubble land, after having only burnt the straw and run the cultivator over the land. It came up well with the early rains, and as soon as it had a good start he put 60 ewes with 40 lambs on to it, and kept them there for four months. They thrived well, and the crop now looks equal to a ton and a-half to the acre if left alone until October.

It is surprising the amount of good feed that goes to waste every year in some of our best country. Every summer thousands of sheep are about among the farms, eating the weeds off the fallow, and breaking down the stubble. The drovers get the feed for nothing. The writer's idea, after having lived among the farmers and watched the waste, is that every agriculturist with 400 acres or more should have at least 50 or 100 ewes. At first, sheep-proofing his fences is the trouble. Buy £25 to £30 worth of 2ft. x 2½in. 18-gauge netting at £7 per mile, and run it around the boundary fence, under the third wire. That will give a good sheep-proof fence, which will keep in even the fence-breaking crossbreds, and can be removed again when the lease is up, if required.

It will not cost more than a week's careful labour, aided by the use of all the scraps of old wire which usually lie around the sheds and fences. The trough for 100 ewes will cost £2. Ten tons of hay and £2 worth of bran will keep those 100 ewes for four or five months, running on the stubble, and forty acres of Majestic wheat will keep them, with the help of a run on the fallow, another six months. There will be still room for his 10 horses and three cows, and he will make enough out of 100 sheep to pay for the rent of the little farm and give him cheap mutton. It often grieves the writer, while travelling over our fertile State, to see so much good sheep country lying idle.

THE GOVERNMENT LABOUR BUREAU.

SEPTEMBER AND QUARTER.

The following is the report of the operations of the Labour Bureau for the month of September, 1905, as also the quarterly statement of the condition of the labour market throughout the State:—

Perth.

Registrations.—The total number of individual men who called during the month in search of work was 814. Of this number 386 were new registrations, and 428 renewals, *i.e.*, men who called who had been registered during the year prior to the month of September. The trades or occupations of the 814 applicants were as follows:—Labourers, 306; handy lads, 64; handy men, 53; farm hands, 41; carpenters, 39; cooks, 38; bushmen, 25; shearers, 18; gardeners, 15; drivers, 14; plumbers, 14; miners 12; grooms, 10; yardmen, 10; engine-drivers, 9; blacksmiths, 8; kitchenmen, 8; bakers, 7; clerks, 7; hotel hands, 7; fitters, 6; painters, 6; wheelwrights, 6; bricklayers, 5; dairymen, firemen, plasterers, strikers, 4 of each; barmen, carpenters (rough), grocers, storemen, 3 of each, and 58 miscellaneous.

Engagements.—The engagements for the month numbered 256. The classification of work found was as follows:—Labourers, 142; bushmen, 19; shearers, 14; cooks, 11; farm hands, 8; handy men, 8; boys for farms, 6; handy boys, 5; carpenters, 3; drivers, 3; kitchenmen, 3; orchardists, 3; blacksmiths, 2; engine-drivers, 2; fencers, 2; grooms, 2; painters, 2; painters' improvers, 2; quarrymen, 2; station hands, 2; yardmen, 2, and 13 miscellaneous.

Fremantle.

Registrations.—The applicants for work numbered 515. There were 275 new registrations and 240 renewals. Of the 275 new registrations, there were 18 bricklayers and 43 carpenters and joiners, the bulk of the remainder being unskilled labourers.

Engagements.—There was but one engagement besides the labour required for the new Fremantle Station improvements, which was principally of an unskilled nature, 156 men being employed.

The female servants who called numbered four. There were no engagements.

Kalgoorlie.

Registrations.—There were 95 new registrations and 52 renewals. The applicants were chiefly unskilled labourers.

Engagements.—The engagements numbered 26, classified as follows:—Woodcutters, 13; labourers, 6; carpenters, 2; blacksmiths, cooks, engine-drivers, handy men, and handy youths, 1 of each.

The female servants who called numbered 84. There were 49 new registrations and 35 renewals. The engagements were 9.

CUE.

There were no callers.

WOMEN'S BRANCH, PERTH.

Registrations.—There were, in connection with the women's branch, Perth, 88 registrations and 116 renewals. The classification was as follows : —Laundress-charwomen, 35 ; generals, 23 ; light generals, 26 ; housemaids, 23 ; cooks, 23 ; useful girls, 20 ; housekeepers, 14 ; waitresses, 10 ; cook-laundresses, 8 ; lady helps, 4 ; nurse-needlewomen, 3 ; barmaids, 3 ; and 7 miscellaneous.

Engagements.—The engagements for the month numbered 66, classified as follows :—Generals, 21 ; laundresses, 13 ; useful girls, 8 ; light generals, 8 ; charwomen, 4 ; lady helps, 4 ; cooks, 2 ; housekeepers, 2 ; and 4 miscellaneous.

GENERAL REMARKS.

At the central office, Perth, 814 individual men called in search of work during September. This total is 124 short of the number for August, and 70 in excess of that for September last year. The engagements numbered 256, this being five in excess of the number for August, and 40 of that for September last year. The railway passes issued during the month to men who had work to proceed to totalled 73, as against 15 for September last year. The refunds for the month on account of railway passes issued amounted to £24 9s. 3d., as against £4 15s. 1d. for September last year. In addition, £12 1s. 7d. was received from employers to send workers.

The number of individual men who applied for work at Perth, from January 1 to September 30, 1905, was 4,643, as against 4,256 for the corresponding period of last year, and 3,572 for the first nine months of 1903, the present number being over 1,000 in excess of the total of two years ago. The engagements for the nine months at Perth, were 2,059, as against 1,951 for the same period in 1904, and 1,548 for the first nine months of 1903. The present number of engagements thus show an increase of 511 over the number in 1903. At the women's branch, Perth, the females who called during the nine months, totalled 1,191, as against 1,287 for the same period of last year. The engagements were 759, as against 707 for the first nine months of last year. At Kalgoorlie, there were 1,059 registrations, and 149 engagements, during the nine months. The women who registered numbered 292, and the engagements were 40. At Fremantle, the individual men who called during the period under review totalled 2,324, and the engagements 346. From January 1 to September 30, 1905, there were in all 9,654 individual men and women called in search of work, while the engagements for the same period amounted to 3,379.

QUARTERLY RETURNS.

The following is an abstract of reports received on the state of the labour market for the past quarter, from magistrates, labour organisations, and others throughout the State. Generally speaking the supply of all classes of labour is sufficient, and in some districts, as at Kalgoorlie, the market is glutted.

At PERTH the only inquiry to note is for first-class cube-dressers and quarrymen.

YILGARN (Southern Cross).—There is no demand for any particular work in this district.

COOLGARDIE.—The supply is sufficient.

COOLGARDIE, EAST (Kalgoorlie and Boulder).—The labour market is very much glutted at present, and there is no special demand in any particular trade or occupation.

COOLGARDIE, NORTH-EAST (Kanowna).—The supply has been equal to the demand in all branches, with the exception, perhaps, of female servants.

COOLGARDIE, NORTH (Menzies).—The supply of labour is sufficient.

YALGOO (Yalgoo, Wolla Wolla, Wurarga).—Some demand has been expressed for miners and for shearers.

MURCHISON (Nannine, Cue, Day Dawn, Mount Magnet).—The laying on of water to the town of Nannine caused an influx of men in connection with the work. At Meekatharra building operations have improved during the past quarter. Generally, the demand for labour is limited to mine workers, of whom the supply is greater than the demand at Cue and Day Dawn.

MOUNT MARGARET GOLDFIELD (Morgans, Malcolm).—The supply has always been sufficient to meet the demand, excepting in the case of the best workmen and domestic servants.

PEAK HILL.—There is no special demand for labour of any class.

VICTORIA (Dongarra, Greenough, Geraldton, Mingenew).—The district being agricultural and pastoral, there is no demand for other than a few shearers and farm hands.

TOODYAY (Toodyay, Newcastle, Moora).—The supply of labour is sufficient for the next six months.

NORTHAMPTON.—Formerly a mining district, but at present stagnant in that direction; farm workers are occasionally in request, and land is being rapidly taken up.

NORTHAM (Northam, Meckering, Doodlakine),—The only demand for any class of labour at present is for domestic servants.

YORK (York, Beverley).—With the exception of domestic servants, and at Beverley some good ploughmen, the labour market is exceedingly dull.

SWAN (Guildford, Gingin, Mundaring).—There is no demand for labour, but at Guildford a number of men are out of work.

MURRAY (Pinjarra, Waroona, Jarrahdale).—The district is principally an agricultural one, for which the farm workers are sufficient.

WELLINGTON (Bunbury, Donnybrook, Yarloop).—Returns not to hand.

PHILLIPS RIVER (Ravensthorpe).—Owing to the firmness of the copper market, there has been a revival in mining in this field, and competent miners are required.

Collie.—Returns not to hand.

Sussex (Busselton).—The supply of labour at Busselton is sufficient in all descriptions.

Blackwood (Bridgetown, Greenbushes).—At Bridgetown there is some little demand for farm workers and domestic servants.

Plantagenet (Albany).—About Albany it is reported work is very scarce, and a good many men are almost idle.

Williams (Narrogin).—Farm labourers and domestic servants are reported to be in request.

Katanning (Katanning, Wagin, Broome Hill).—A slight demand exists for labourers, chiefly mallet bark strippers.

Esperance.—The supply of all classes of labour is in excess of the demand.

FEDERAL TARIFF COMMISSION.

The Vine Growing and Wine Making in Western Australia; Alterations of Excise Duty recommended; Fruit Juice and Lime Juice; Vinegar; Date Palm Culture.

Viticultural Expert Examined.

Adrian Despeissis, Government Viticultural and Horticultural Expert, presented a return showing the progress of vine-growing in Western Australia. Prior to 1894 vine-growing was conducted on a very small scale. In 1895 the acreage under various kinds of vines was:—600 wine, 500 table, 700 young, total 1,800 acres. There was a steady increase until 1901, when the figures were:—1,710 wine, 1,057 table, 862 young, total 3,629 acres. Since that date there had been a falling off in wine and young grapes, but table varities had continued to increase, the figures for 1904 being—1,445 wine, 1,524 table, 444 young, total 3,413 acres. This return, witness stated, showed that since Federation the planting of wine grapes had been on the decline. Several small and unprofitable vineyards had been either grubbed out or grafted over with eating grapes.

The following table gives the acreage under vines from 1895 to 1904:—

TABLE A.—GRAPE VINES.

Year.	Productive.		Young Vines not bearing.	Total.
	For Wine.	For Table.		
				acres.
1895	600	500	700	1,800
1896	938	545	811	2,294
1897	1,253	533	869	2,655
1898	1,290	589	1,082	2,961
1899	1,400	721	1,124	3,245
1900	1,469	888	968	3,325
1901	1,710	1,057	862	3,629
1902	1,660	1,184	684	3,528
1903	1,530	1,177	617	3,324
1904	1,445	1,524	444	3,413

In answer to the Chairman as to whether the introduction of wine from the Eastern States had interfered with the progress of vine-planting, witness said it was feared at the time of Federation that it would do so. It was only within the past year or two that the competition of wine from the Eastern States had been felt; but two or three years before that competition became an accomplished fact growers stopped planting vineyards.

TABLE B.—WINE PRODUCTION.

Year	Gallons
1895	50,000
1896	60,000
1897	75,693
1898	89,099
1899	113,799
1900	86,802
1901	130,377
1902	185,725
1903	158,853
1904	138,371
1905	186,000

Witness also produced a return showing that the local production of wine had increased nearly fourfold in 10 years. In 1895 it was only 50,000 gallons, while the present year's production was 186,000 gallons. That showed a substantial increase. In 10 years the production of wine had increased nearly fourfold. The present-day increase was due to the spirited planting of the days previous to federation, to more suitable pruning and tending, and to the more general use of fertilisers. It took from three to five years before a vineyard could be sufficiently productive to grow a crop; and, of course, those vines planted in 1900 or 1901 were now bearing. It would take a long time to make Australia a wine-drinking nation. The

NARROGIN.

Mr. Greham's Homestead. A picturesque Farm.

taste was more towards ardent spirit and beer, most of which was labelled whisky and brandy. The idea prevailed that a great proportion of that spirit had received admixtures of rectified spirit manufactured from beetroot, potatoes, Jerusalem artichokes, etc. By encouraging the establishment of distilleries a good deal of wine unfit for direct consumption would be utilised and the market relieved; and, at the same time, a taste for better wine would be cultivated. Before federation the difference between the import and the excise duty was 4s. to counteract the higher cost of labour and the prejudice against anything new and local. Unfortunately, that prejudice did exist, but in the course of time it would disappear as a good class of spirit was made, and when people cultivated a taste and discovered that the spirit was as good as, or perhaps better than, the imported article. With federation, the duties were fixed to 14s. for imported and to 11s. per proof gallon for local spirit. The difference of 3s. was not enough by a long way. By re-adjusting the excise duty they would encourage the production of wine and increase the acreage under vines. The spirits manufactured to encourage the production of wine should be made from a grape that yielded large crops of a neutral wine—a wine without any special kind of aroma that could be made into a spirit such as was done in the Cognac country in the western part of France; one with no great distinction of its own. It was rather tart when young and new, but it was one that made a very good brandy. The wine-grower considered that the difference of 3s. per gallon between the import and excise duties on spirits made from Australian wines did not leave sufficient margin. Until federation was talked of, schemes were propounded for establishing central wineries and encouraging the cultivation of vineyards and making wine, either for the purpose of exporting it or for making spirits; but these schemes were rather vague, and they did not command the support of wine-growers. It was felt that the

Reduction of the Excise

should only apply to spirit made of wine or grain. A good deal of mock whisky and brandy found its way into the local market. It would be well to have a clear definition of what brandy was. Witness did no think that such a definition had been adopted in Australla. That of the United States Department of Agriculture appeared to be a good one. It was "the distillate of wine properly aged by storage in wood." Before federation wine-makers could use wine spirit for the purpose of fortifying their wines up to 35deg. proof by paying a reduced duty of 6d. per proof gallon to cover the cost of supervision. Since federation this reduced duty had been raised to 1s. per proof gallon. It was felt by wine-growers that the duty should be brought down to what it previously stood at. This would result in a saving of a good deal of wine which, for want of sufficient care, went bad, and was forced on the market at a reduced price, thus causing a dislocation of the internal wine trade, and also harm to the consumer. They thought it was admitted that a duty of 6d. per proof gallon would cover, in most cases, the cost of supervision. Of course, in the case of the fortification of wine at distant places, where only a limited quantity of spirit was used at a time, it might not be enough, but in other cases closer to the headquarters of the excise officers the cost of supervision would be considerably less than 6d. per proof gallon. Orchardists and fruit-growers advocated encouraging the use of pure wine spirit in

Preserving Fruit Juice

in the same way that wine-growers did. Now it was only the wine-grower who could buy grape spirit at the reduced duty of 6d. per gallon to fortify his wine; and it was felt that the same privilege should be extended to fruit-growers in manufacturing the juice of the fruit in marketable qualities. A good deal of the limejuice introduced to Australia contained from 13 to 14 per cent. of proof spirit, equivalent to $6\frac{1}{2}$ to $7\frac{1}{4}$ per cent. of pure alcohol. Limejuice cordial contained 7 to 8 per cent. of proof spirit, equivalent to 3 to $3\frac{1}{2}$ per cent. of pure alcohol. By extending to orchardists who desired to manufacture limejuice the privilege enjoyed by wine-growers, extensive areas of land, which had been proved eminently suitable to growing limes and lemons, would be cultivated in this country. At the same time, a good deal of wine spirit would be used, which would also encourage vine-growing and the planting of vineyards to manufacture and prepare for the manufacture of limejuice. Ten or eleven years ago Sir John Bennett Lawes had inquiries made in Western Australia as to the capabilities of a stretch of land he owned on the Irwin River with regard to the

Cultivation of Limes and Lemons,

his idea being to establish the manufacture of limejuice and also candied peel. There were great stretches of country where lemons, limes, oranges, and all citrus fruits would grow to perfection in this country; and witness thought it would be quite feasible to encourage farther planting if they could turn the produce of those orchards into other commodities than it was now used for, that was to say, if they could preserve the juice of limes and lemons and place it on the market as the demand arose. Also a good deal of the limejuice that was now imported could be made locally. Limejuice did not keep unless it was fortified to a certain extent. If that fortification could be done locally with wine spirit manufactured in Australia, and if orchardists were allowed the same privilege as was now given to vine-growers, he thought it would encourage the planting of large stretches of country for the manufacture of limejuice, and, incidentally, for the manufacture of candied peel. The high duty on limejuice was the cause of much acid and acrid liquid labelled "limejuice," and made up of mineral acids, being sold to the public. There were some very good brands of limejuice; but there was limejuice which was more or less adulterated by means of mineral acids deleterious to the consumer. He would like to say a few words

With reference to Vinegar.

A number of people in Australia had never tasted vinegar. By that he meant liquid made from wine which had been fermented by means of acetic fermentation, the alcohol of which had been turned into acetic acid. That vinegar, like true malt vinegar, had a special flavour or aroma of its own which vinegar made from other sources did not possess; and when the public asked for vinegar they ought to get vinegar instead of another article made in another way. Vinegar varied as much in quality as did wine. There was a taste in vinegar which became cultivated just as there was in wine. For instance, a very good vinegar might be made from the juice of the apple—a cider vinegar. It would have an aroma of its own, very unlike vinegar made from wine. Also vinegar made from different wines would develop different aromas. A couple of years ago, while in the South of Spain,

witness visited the town of Xeres. He went to some of the extensive bodegas, particularly that of Gonzalez, Byass, & Co., and he was shown large stacks of butts (100-gallon casks) which he was told contained vinegar in the process of maturing. Some of it was fifteen to twenty years old, and he was told that only dukes, epicures, and rich Jews could afford to buy it. It had a flavour and aroma of its own; and it was considered a very rare commodity and almost as valuable as some of the high-grade sherries that were maturing in the cellars or bodegas there. A good definition was given for vinegar in a test case heard in July, 1893, before the Birmingham Quarter Sessions. It was:—" A vegetable juice which has undergone alcoholic and acetic fermentation." The Recorder held in connection with that case that wood acid was not vinegar, although there were witnesses examined before him who contended that vinegar was anything that contained acetic acid of such purity and of such dilution as to be capable of being used for food. Some vinegar fakers sold wood acid or pyroligneous acid vinegar as " pure unfermented vinegar." Pyroligneous acid treated by means of lime or soda lost some of its tarry products and became acetic acid. Some vinegar "fakers" advertised " pure unfermented vinegar," and the term, witness said, as used was, of course, correct so far as it went, but pure vinegar should be fermented twice. In the first instance the juice of the grape, or the juice of the fruit, underwent alcoholic fermentation, and then the spirit of that underwent a second fermentation, which was acetic fermentation, and the result was it might be malt vinegar, wine vinegar, or cider vinegar. By raising the duty on acetic acid and pyroligneous acid to such an extent that its use became impossible to the manufacture of vinegar, not only a considerable quantity of wine tainted with sourness, but of cider made of windfalls or otherwise poor grade apples, would be fermented in the usual way and subsequently subjected to the acetic fermentation and turned into vinegar of good quality and pleasant aroma, and with none of the noxious qualities of "faked" vinegar made of acetic acid, distilled from wood and coloured with burnt sugar, and flavoured, to suit the consumers, with essences of vinegar.

In answer to the Chairman, witness said a reduction of 6d. in the excise duty on spirit used for fortifying wine would relieve the market of a good deal of unsound wine. The growers would be encouraged to use the fortifying spirit to a greater extent. There had not been much objection raised to the percentage fixed for fortified wines. The present maximum of 35 degrees he thought was fair, but a degree or two extra would not be injurious. If the export market required wine very strongly fortified, witness thought the Australian growers should cater for the trade. It was a good plan to use brandy for fortifying wine. It was a wine spirit specially distilled that had been reduced, and if it was of fair age it was a great advantage to use it for fortifying the higher class wines. There was no reason for the limitation of 35 degrees over-proof that witness was aware of.

By Mr. Clarke: The climatic conditions in Western Australia were favourable to the production of wine. In every branch of wine-making favourable conditions existed locally. It was accepted generally that a good deal of the cheaper vinegar on the market was not made from vegetable juice, but was a dilution of wood acid. Witness certainly thought that vinegar made from either malt or fruit juice would be more wholesome than that made from wood acid. It should be shown distinctly on the label of the bottle what the vinegar was made of. That would protect the public health as far as possible, and encouragement would be given to the wine industry.

By Mr. Wamsley: With a view to encourage the production of pure malt vinegar he would suggest that the duty on that item should remain as it was, but the tariff might be increased on vinegar that was not made from either malt grain or from fruit juice. An *ad valorem* duty would be fair, but it might complicate matters. The approximate spirit strength of local wines was from 22 degrees to 30 degrees proof, and it was particularly applicable for spirit-making. The grapes that were likely to be grown here for spirit-making would average about 25 degrees. The tonnage of grapes to the acre would depend upon the variety of the fruit. Some vines would yield about a ton and a-half, and others of low spirit strength would go up to six tons. Wine to the value of about £9,000 was imported from the Eastern States in 1895, and yet in 1903, when the duty was less, there was a falling-off. This, he had heard, was due to overstocking. Local growers were maturing wine now, and a better article would soon be put on the market.

By Mr. Fowler: Vignerons had not complained of the supervision. The industry was only in a small way. Since federation there had been an apparent disinclination to plant vines for wine-making purposes., but there was no reason why the local grower should not compete with those of the other States if he got a fair start. Witness had never known in Western Australia of a comparative failure of the grape crop. The hot winds that did so much damage in the Eastern States were not felt here so severely within 75 or 100 miles of the coast. Vinegrowers would like to see only pure grape spirit used for fortifying wine. The spirit was of better quality and less fiery than the root-spirit and would not add any injurious qualities to the wine.

By Mr. McGregor: It was possible to grow grapes for brandy distillation here to compete with the other States. If local growers were allowed to fortify up to 40 degrees it would place them on the same footing as foreign makers in respect to high-class sweet wines. It was not to the advantage of the vigneron to fortify his wines to a great extent.

With reference to spirits, item 2, 14s. per gallon, witness, in answer to the chairman, said the distillation of spirits as an industry had not yet been adopted in the State. Five or six years ago inquiries were made as to the possibilities of planting vines on a large scale, with a view to manufacture spirits. The difference between excise and import duties was then 4s., and there seemed to be sufficient protection to encourage a local industry. Since then, however, the difference had been reduced to 3s. per gallon, and now, with the higher cost of labour, it was not considered a profitable undertaking. It was not likely to be started unless some greater encouragement was given. The materials that spirits were generally distilled from were wine, grain, roots, and anything that contained sugar. Western Australia was capable of producing the necessary raw material, and the growers, witness thought, would be justified in launching out into the industry. The Federal import duty was 14s. per gallon, and the excise duty on spirit distilled from Australian wines was 11s. per gallon, leaving a difference of 3s. Witness thought there should be a reduction of about 4s. in the excise duty to encourage the industry. There was a great similarity between the conditions of South Australia and Western Australia, except that here there was a more reliable rainfall, and the crops were not so subject to the hot spells, hail storms, and parching dry winds. The production of spirits, he thought, would be an important local industry in years to come.

The witness had not concluded his evidence when the Commission adjourned to a date to be fixed on the return of the members from the goldfields.

The Federal Tariff Commission, consisting of Sir John Quick (chairman), Messrs. G. McGregor, a South Australian member of the Senate, J. M. Fowler, M.H.R., G. W. Wamsley and F. Clarke, having returned from the goldfields districts, sat again at Parliament House on Friday, the 6th October, and took further evidence.

Viticulture.

Adrian Despeissis, Government horticultural and viticultural expert, who had been under examination when the Perth sittings were previously adjourned, continued his evidence, and said, in answer to Mr. Wamsley, that the definition of brandy in the United States was "the distillate of wine properly aged by storage in wood." Spirit made from lees and stalks would not be good brandy.

By the Chairman: Witness had had an opportunity of perusing the evidence given before the Commission by Dr. Harker, in Sydney. It was very full evidence, and he had nothing to add to it.

By Mr. Fowler: Tucker's definition of brandy was a good one. It was: "The juice of the grape distilled at a strength that would enable it to retain its properties." Witness agreed with that. Taking the two definitions together, he thought one should be the complement of the other.

Vinegar and Fruit Juice.

By the Chairman: Witness read over the evidence he had already given with regard to vinegar made from wine and subjected to acetic fermentation. The vinegar which he referred to as "faked" was extensively used. The duty of 6d. per gallon on that liquid was apparently not sufficient, and he thought it would encourage orchardists and vine-growers to produce good vinegar if the duty was increased. Good vinegar could be made from apples, malt, and grain, as well as from acetic fermentation of wine.

By Mr. McGregor: Vinegar could be manufactured from sugar, but it would have to undergo alcoholic fermentation first, and it could then be quickly transformed into vinegar.

Witness reviewed the evidence which he had previously given with respect to limejuice, and said that the limejuice upon which an import duty of 9d. per gallon was charged was non-spirituous. Witness thought that a special provision similar to that for spirits for fortifying wines should be made applicable to the spirit for fortifying limejuice and other fruit juices.

By Mr. McGregor: Witness suggested that raspberry vinegar or any sort of fruit juice in any particular form, and which required the addition of spirit, should be treated as wine. To encourage the growth of the manufacture of those fruit juices, he would recommend that the present duty should be reduced to 6d.

By Mr. Fowler: It might be advisable to formulate a regulation so that a certain percentage of spirits in fruit juices could be rendered exempt from duty. People were not likely to use those spirits for their alcoholic properties.

CULTIVATING THE DATE PALM.

A Valuable Industry.

Climate and Soil Suitable.

Mr. Despeissis, continuing his evidence before the Federal Tariff Commission, gave information in regard to date palm culture. He said he had noticed, in looking over the tariff, that in item 21 there were three specific duties—currants, 2d. per lb.; dates, 1d. per lb.; and raisins, peel, ginger, etc., 3d. per lb. He was very much struck, when travelling through Algeria, with the importance of the cultivation of the date palm, and there were great stretches of country in Western Australia and South Australia where the date palm could be very successfully cultivated. It occurred to him that a great quantity of dates were imported into Australia, and it might be possible to encourage date culture. A date palm took five or six years before it began bearing. To put an increased duty on dates at present would be hardly fair to consumers, but it would be encouraging to growers if they knew that the duty would be raised 1d. per lb. later on. The dates we had here were very inferior. The Department of Agriculture had lately imported some choice date palms from Biskra, on the border of the Sahara. In South Australia there were some palms growing very successfully; these came from Algeria, and were doing well. The department had no farms in the desert parts of this State, but they had given suckers to some people in districts where the air was dry and where the water table was near the surface. He thought the Eastern goldfields region would grow date palms very well, and also the North-West country from Roebourne to Wyndham. Biskra, in Algeria, was once a very small place, but since artesian boring had been carried out, it was a most successful centre where caravans met, and companies had been formed there to carry on the industry of date culture. Biskra was 300 miles inland from Algiers on the southern slope of the Atlas range of mountains. It was better to plant suckers than seedlings, because there was more certainty as to the quality and the character of the palm. If one planted seeds one might get a large proportion of male trees, and there would be uncertainty as to the class of date.

To Mr. Wamsley: In regard to the relative value of dates and currants, taking quality for quality, he was aware that the dates were of much less value than currants, which were charged duty at 2d. per lb. Some Algerian dates, however, of high quality, sold at from 6d. to 9d. per lb. There was quite as much work in preparing dates as in preparing currants; in dates there was the labour of climbing trees, which was not the case with currants. Both fruits had to be dried, but dates were easily prepared. The stalks were cut off the tree, and they were dried on mats. Dates contained 50 per cent. to 60 per cent. of sugar, and required much less drying than currants. As to one Parliament being able to bind another, as they were triennial, he had suggested that as the palm took five years before it became fruit, the advisability of encouraging date culture was worthy of consideration, and some measure might be introduced to increase the duty later on.

To Mr. Fowler: The date palm required more moisture than was generally supposed; it could, however, do without much rain, so long as the water was in the ground. It had long, fibrous roots, that went down to a good depth, and could assimilate water which was even brackish. He had seen "soaks" on the way to the goldfields, and those localities would be probably suitable for the cultivation of the palm, and it should be a fairly

profitable industry. Fresh dates would be in good demand if attractively packed and displayed for the market, and the date was very palatable and nourishing. Apart from the utilitarian aspect, date palm groves would greatly relieve the appearance of the country. There were date-palms growing in Algiers in quite arid districts.

To Senator McGregor: Date culture afforded a means of livelihood to many people. The climate was suitable here because they could sun-dry fruit without fear of thunderstorms or rain. Sun-dried fruit was superior to kiln-dried, as it kept its bloom and flavour better.

To the Chairman he said that the provision in the tariff for duties to come into operation on a date to be fixed by proclamation, in regard to certain industries which were prospective, he thought a good one, and this was what he had in his mind when he suggested the duty on dates being increased later on, when time had elapsed for the palms to arrive at maturity.

This concluded Mr. Despeissis' evidence, and the chairman thanked him, saying it was very valuable, and would be of great use to the Commission.

BEE NOTES FOR NOVEMBER.

By John Sutton, Bee Expert.

While swarming will mostly be over by the end of October there will be but little to add for the work of November, except to see that those colonies that have already swarmed are making progress in breeding. Care should not be abated till there is ample proof that the queen is equal to her position, and is supplying the needs of the workers.

In cases where the queen is failing it is more than likely to get ready for swarming again, or in some cases the workers will simply rear another queen and supersede the old one. Whether this is wise to let them do so, is quite another matter, and will depend upon the record the old queen has already got.

While there may be a little honey coming in, and is being freely stored, it does not necessarily indicate that extracting should begin; better to wait and see if there is a prospect of a continuance of a honey flow before removing honey so soon in the season; far better to give extra room if it be required, and leave all stores severely alone for a while.

Where swarming is completely finished, see to it that every colony is put into the best condition possible. Get every colony strong, using every proper and legitimate means to this end. But here is where knowledge and experience is required, as, for instance, if two colonies are doubled up to make a strong one, and the queen is not equal to the change, it is more than likely such a colony would be no better for the extra given them, for they

would be reduced in numbers within 21 days, but where a good prolific queen is known to reign, the conditions being favourable, would give the best results.

There are many good practical beekeepers who do not approve of this method of doubling their weak colonies. I am quite aware, and the reasons they assign are quite correct, under certain conditions, but where honey is the prime object small colonies are not only useless, but worse than that. The attention they require makes them an expensive and costly care, with no redeeming features whatsoever; hence, keep good stocks, and there will be but little trouble to keep them strong.

Everything depends on the weather conditions to a large extent, but even when unfavourable weather obtains strong colonies give by far the least trouble.

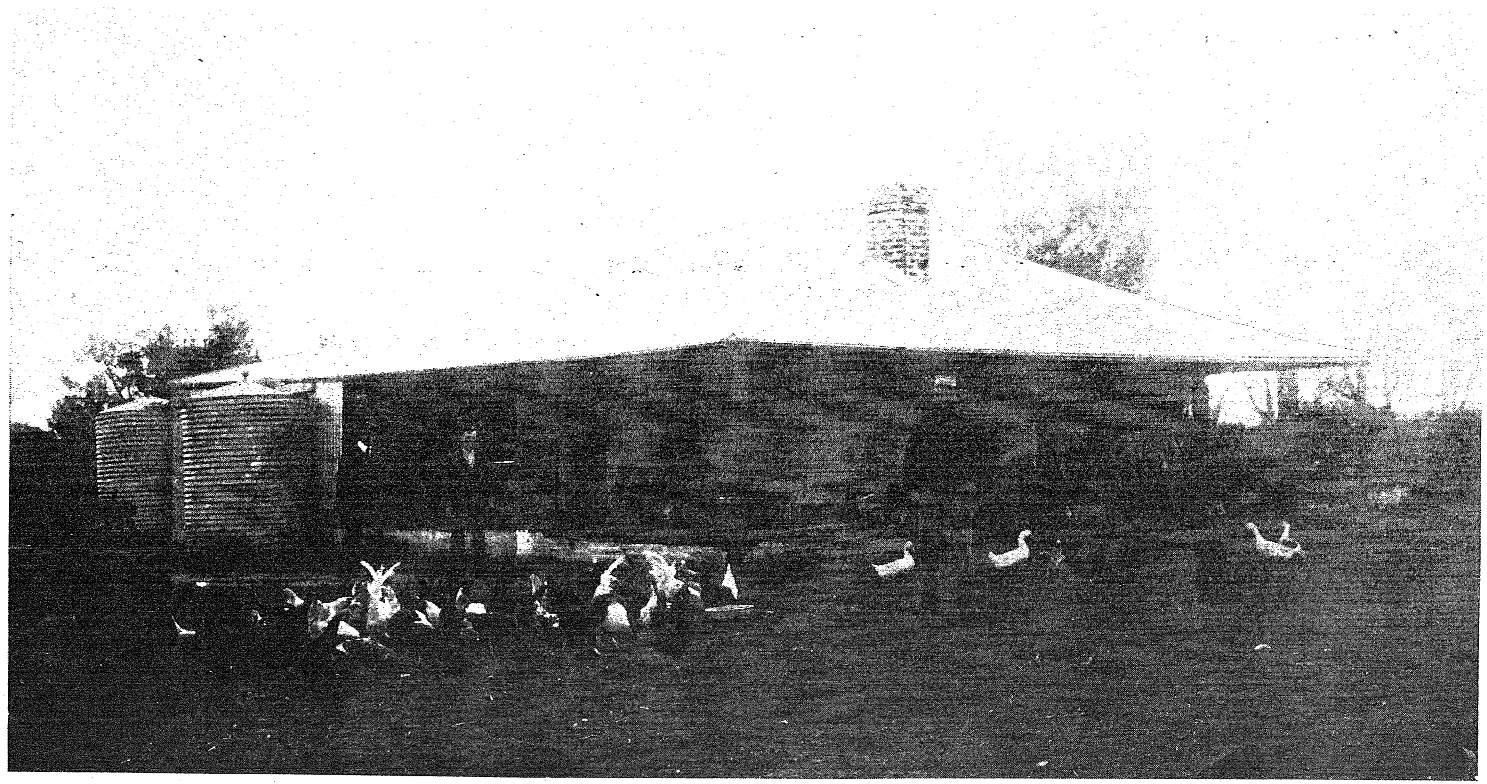
Feed, where necessary, with syrup of say two of best sugar and one of water, properly and thoroughly mixed, and where possible feed warm in the evenings with either the Boardman, Doolittle, or Miller feeder, taking care not to disturb the brood nest more than can be avoided.

MILK FEVER: ITS SIMPLE AND SUCCESSFUL TREATMENT.

For some time past a number of complaints have been received of cases of milk fever in dairy cattle. The United States Department of Agriculture has issued a bulletin on the subject, written by Mr. John R. Mohler, V.M.D., the chief of the Pathological Division, Bureau of Animal Industry, which we reproduce for the benefit of the dairymen of this State.

Preliminary Remarks.

Milk fever is very common, and until recently a frequently fatal, disease affecting cows in all the large dairy districts of this and other countries. As it usually attacks the best milking members of the herd and at a time when the milk flow is the heaviest, the malady is one which has caused very severe losses to our dairy industry. It is therefore of the greatest economic importance that every milk producer acquaint himself with the present extremely successful methods of treating this disease, especially the injection of filtered atmospheric air into the udder. This form of treatment has been adopted within a comparatively recent time, and, in view of the uniform success that has followed, every dairyman should become familiar with its use and should provide himself with a suitable apparatus for its application, especially if he is located where the services of a competent



NARROGIN.
MR. E. A. CAMERON'S HOLDING.

veterinarian can be secured. This method of dealing with the disease does not make the assistance of the veterinarian undesirable, in case it is obtainable, as the professional man may frequently be of the greatest assistance in treating complicated systems, should they arise.

Name and Synonyms.

The common name for this malady—milk fever—is an erroneous and misleading one, as in reality fever is usually absent; instead, there is generally an actual reduction in body temperature. A far better and more distinctive term, and one that describes the actual condition much more precisely, is parturient paresis. The disease has also several other names in various parts of the country, such as calving fever, parturition fever, parturient apoplexy, parturient collapse, puerperal fever, vitulary fever, and dropping after calving.

Description of Disease.

Milk fever is a disease of well-nourished, plethoric, heavy-milking cows; it occurs during the most active period of life (fourth to sixth calf), and is characterised by its sudden onset, and the complete paralysis of the animal with loss of sensation, and by following closely the act of calving, or parturition, terminating in a short time in recovery or death. One attack predisposes the animal to a recurrence of the trouble. While this disease may occur at any time during the whole year, it is seen principally during the warm summer season. The affection is almost entirely confined to the cow, although a few cases have been reported in the sow and goat. Sheep are entirely free from the disease.

Predisposition and Cause.

There are few diseases among our domesticated animals regarding the exact cause of which more widely different theories have been advanced than that of milk fever. The causes may properly be divided into two kinds—predisposing and direct. Experience shows one of the most prominent predisposing causes to be the great activity of the milk-secreting structure, namely, the udder. This organ is most active after the fourth, fifth, and sixth parturition, and this is the time of life when the vast majority of cases occur. The disease is almost unknown in heifers with the first calf, and decreases in frequency steadily after the most active milking period is past. It is rarely, if ever, met with in pure beef breeds, such as the Shorthorn, Angus, and Hereford, while its main inroads are made into the heavy-milking breeds, such as the Holstein, Jersey, and Guernsey. Another factor that is probably of equal importance with the activity of the udder in producing the disease is the existence of a plethoric condition of the system, the result of excessive feeding and lack of exercise before calving. In heavy-milking cows all the food eaten in excess of that required to make up for the normal waste of the system is turned into milk and not used for the laying on of flesh or fat. Fleshiness is, therefore, an unnatural condition in these animals, and the period during which they are "dry" is usually very short; indeed, many of these cows continue to secrete milk right up to the time of calving. In those cases where the animals go dry the excess of nutriment in the food has no avenue of escape and immediately becomes stored up in the glands and in the blood, throwing the system into a high state of plethora. Now, at the time of calving, all the blood which has been supplying the fetus is suddenly thrown back on the circulation,

and if the udder does not begin active secretion very promptly plethora becomes extreme. The blood plasma under these conditions is very rich and dense, containing a large percentage of albumen and glycogen, and causing a shrinkage in size of the blood cells. This condition is invariably seen when the blood of milk-fever patients is examined under the microscope.

Fatness of the animal has been ascribed an important place among the causes of milk fever. This, however, in itself is probably not a predisposing cause. The beef breeds (Angus and Shorthorn) are usually in far better condition at the time of calving than the milking breeds (Jersey and Holstein), and yet milk fever is a rarity in the former. At the same time it must be understood that a fat Jersey is more predisposed than one poor in flesh. In the fat Jersey the system is already loaded with an excess of nutriment, and, at the time of calving, extreme plethora is more readily produced than in the thin animal where the excess of nutritive elements could be more readily used and stored in the depleted muscular and glandular structures of the body. Fatness is therefore only of importance in the production of the disease in so far as it tends to increase glandular activity, particularly of the udder, and because of the higher state of plethora of the fat animal.

Regarding the direct cause of milk fever, numerous theories have been advanced by various investigators, but only to be abandoned as further discoveries in pathology were made. Thus Schmidt, of Mühlheim, basing his theory upon the striking resemblance of the symptoms of milk fever to those of sausage poisoning, claimed that the former was due to an auto-intoxication, produced by the absorbtion of toxins from the uterus. This was a great advance over the theories which up to this time had been considered. Nevertheless, the medication recommended by this writer, which aimed at the antiseptic treatment of the womb, failed to decrease the great mortality of the disease, and his theory was finally entirely superseded in 1897 by that of J. Schmidt, of Kolding, Denmark. This able investigator first directed attention toward the udder by claiming (as Schmidt, of Mühlheim, had done) that the disease was an auto-intoxication, but produced by the absorption from the udder of leucomaines, resulting from the decomposition of the first milk (colostrum). Following up this idea Schmidt considered that the treatment should be directed toward retarding the secretion of the udder and at the same time neutralising the leucomaines, or toxins, already present, by the use of some anti-toxic agent. He therefore advocated the injection of the udder with an aqueous solution of potassium iodide, which method was followed by an immediate decrease in the mortality to a very marked degree. The great success attendant upon this line of treatment at once gave the theory general recognition, and this very difficult problem was at last thought to be solved. Within the last few years the injections of etherised air, oxygen, and sterile atmospheric air have been used with wonderful success, reducing the death rate much lower than the potassium iodide had done. It therefore seems that a thorough distention of the udder is far more important than the antitoxic action of potassium oidide.

In explanation of the efficiency of this treatment some writers have claimed that, after calving, the determination of blood is suddenly changed from the uterus to the udder, which produces an anæmia (bloodlessness) of the brain. By thoroughly distending the udder the pressure therein causes a decrease in its circulation, which tends to equalise the distribution of the

blood in other parts of the body, thus relieving this anæmia of the brain and the consequent symptoms of milk fever. It has also been suggested that the highly favourable results obtained by the injection of atmospheric air and other gases into the udder are due to the fact that milk fever is produced by an anærobic organism (a germ unable to live in the presence of air) which invades the udder. If this should prove true, it is probable that the organism remains localised in the udder, as the bacillus of lockjaw remains localised at the point of injury, and produces a highly potent toxin, which, when absorbed into the system, has a specific action on the nerve centres. These theories, however, have not been proved, and the determination of the cause of this affection still requires investigation.

FIG. 1.—Cow affected with milk fever.

SYMPTOMS.

This disease in its typical and most common form is comparatively easy to diagnose and one which almost every dairyman knows immediately before the arrival of the veterinarian. It usually comes on within two days after the birth of the calf and is practically never seen after the second week. In isolated instances it has been observed a few days before calving. At the commencement of the attack there is usually excitement; the cow is restless, treads with the hind feet, switches the tail, stares anxiously around the stall or walks about uneasily. She may bellow occasionally, show slight colicky symptoms, and make ineffectual attempts at relieving the bowels. These symptoms are rarely recognised by the owner, but they are followed within a few hours by beginning paralysis, indicated by a staggering gait, especially in the hind legs, and by weakening of the knees and fetlocks in front. The patient now becomes quieter, the gait more staggering and weak, and finally the animal goes down and is unable to rise. The paralysis by this time is general, the calf is unnoticed, and the cow lies perfectly quiet with the eyes partly closed and staring and showing a complete absence of winking when the eyeball is touched. She is absolutely unheedful of her surroundings and flies may alight with impunity on all parts of the body without causing the slightest movement to dislodge them. While down the patient assumes a very characteristic position (see fig. 1), which is of great aid in diagnosis. The head is turned around to the side (usually the left) and rests on the chest, causing a peculiar arching of the neck.

(To be continued.)

GARDEN NOTES FOR NOVEMBER.

By Percy G. Wicken.

With November we may expect the first hot days of the summer; the cereal crops will be ripening and haymaking will be general, and in the earlier parts the wheat will be fit to cut for grain; gardening operations on a farm will be therefore somewhat neglected, but an effort should be made to prevent the ground from becoming caked. Bush fires are likely to occur; the winter and spring have been favourable to the growth of grass, and as soon as this becomes dry the danger from fires becomes great. All round the homestead paddocks a strip of land should be cleared of all growth and ploughed up as a protection against fire. If the orchard and vegetable garden are kept well cultivated and free from weeds they are protected against fire, while the moisture is conserved in the ground, and the trees and plants benefited thereby. The vegetables planted out last month should have now obtained a sufficient root hold of the ground to enable them to withstand the dry weather. Any plants which it may be necessary to transplant during this month will require to be well shaded from the sun until they obtain a firm root hold, otherwise they will wilt up. Any backward plants should be watered with a liquid manure, a little sulphate of ammonia or superphosphate dissolved in water and applied a few inches away from the roots. Neither the liquid manure or other fertiliser applied as a top dressing should be allowed to touch the stem of the plants. Those who have been able to conserve a supply of the surplus water during the summer months can now obtain the benefit of the water, and keep the trees and plants growing much longer than in places where water is not available. Where water is available a number of vegetables can be sown to keep up a supply during the summer, but where no water is available very little can be sown for the next few months, and attention must be given to keeping the plants already in free from weeds and to help them along as much as possible.

Beans of the French or kidney variety can be sown wherever there is sufficient moisture in the soil to germinate the seed. Those already growing will be benefited by the application of a dressing of sulphate of potash and superphosphate mixed together and applied either in the form of liquid manure or dusted between the rows and lightly raked in. The pods should not be allowed to become too old, otherwise the plants soon cease bearing.

Beans (Lima) can be largely sown in the early part of this month. Dwarf varieties can be sown and treated the same as French beans, but some of the climbers are very strong growers and require to be staked or tressled. They bear heavily, and make an excellent vegetable and should be largely grown.

Beans (Madagascar) are hardy and prolific and great climbers; are useful for shade as well as for food. The pods grow in clusters, and the whole pod is eaten. They can be planted early in November.

Beet (Red).—The Globe variety is the best for the summer. They should be sown in drills in well manured soil. The seed is slow in germinating, and should be soaked before sowing, and planted in moist soil.

Beet (Silver).—This is a splendid vegetable for the hot weather; the leaves remain green and succulent, and provide green stuff for the table or for the stock.

Cabbage.—In moist spots, or where irrigation is possible, cabbages may be planted out, but it is useless elsewhere. Those already up may be top-dressed with a little nitrate of soda, but this should not be allowed to touch the leaves. If grubs are troublesome, the plants should be sprayed with Paris green and water—1 oz. to 10 gallons of water; make the Paris green into a paste before adding the water.

Carrots.—A few rows may be sown to keep up a supply.

Celery.—Plants already growing should be earthed up, so as to cause them to bleach. A little seed may be sown for future use.

Choko.—A few of these fruits may be put out. They will soon sprout; they are good climbers, and make a change as a vegetable. They grow well in the hot weather.

Cucumbers.—Early sown plants are now bearing fruit. Where there is sufficient moisture a few more seeds may be sown.

Egg Plants.—Plant out any young plants and shade from the sun. In moist localities a little more seed may be sown.

Maize.—Sweet maize for table purposes should have a place in every garden. If planted in rows and the cultivator kept going between the rows, it will stand a considerable amount of dry weather.

Melons and Pumpkins.—The land between the hills should be kept well cultivated until the vines commence to run and cover the ground. After this the vines should not be disturbed. Seed of the bugle pumpkin and other later varieties may be sown, but the hills should be mulched with stable manure.

Okras.—Plants raised for seed, planted last month, will now be ready for transplanting. The plants will require shading from the sun until the roots obtain hold of the ground.

Sweet Potatoes.—Shoots and cuttings from tubers already planted should now be available for planting out. The cuttings should be set on ridges three feet apart and about 12 to 15 inches apart in the ridge. Keep the ground cultivated until the vines begin to run.

Tomatoes.—Fruit from the early districts will now be coming into the market. In the cooler districts a further supply of plants can be planted out. If the plants are staked and kept off the ground a much better yield of fruit is obtained, and the fruit is freer from disease. Only smooth-skinned varieties should be sown, as these are always the most saleable and command the best price.

Farm.—Hay-making will be the principal business on most farms during the month. The season so far has been a favourable one, and should it

continue so during the concluding weeks the hay harvest should be heavy. The season is somewhat later than usual, and in many respects this is an advantage, and we are more certain of settled weather for hay-making. Our harvest, owing to the large area of country which is included in the agricultural area, extends over a considerable time, some districts having cut their hay and harvested the grain crop before others have started to cut for hay, consequently it is somewhat difficult to write notes which apply to all parts. Chaff having reached a high price, there is no doubt that a considerable quantity of new hay will be chaffed and sent to market as soon as possible, but care should be taken that the hay is thoroughly dry before being cut and bagged, otherwise it is likely to become heated and result in loss to the grower. If not already sown, such plants as cow peas, soy beans, velvet beans, sorghum, and rio or bugle pumpkins can be sown in well-prepared land early this month, but the surface soil must be kept well stirred to conserve the moisture.

LOCAL MARKETS' REPORTS.

MESSRS. GUTHRIE & CO.'S REPORT.

Messrs. Guthrie and Co. report, under Saturday's date, as follows:—Fresh arrivals at Perth from the country consisted of 15 trucks, not one of which could be described as sound prime, the bulk consisting of medium and damaged lines. There were one or two trucks of imported chaff in the yard, which, however, were not offered. Buyers were in fairly good attendance, but bidding was not spirited and the sale dragged. Doubtless, the poor quality of the chaff forward was in a large measure responsible for this. Had there been any prime chaff in the yard it would have met with good competition, although prices at this end are now not on parity with the ruling rate at Kalgoorlie. Our market rules as under:—Prime green wheaten, nominal value £6 10s. to £6 12s. 6d.; f.a.q., £6 5s. per ton; good medium, £5 15s. to £6 5s.; medium, from £5 per ton upwards; inferior chaff was very weak, at from £2 10s. to £3 10s. per ton. Algerian oats.—Market unchanged; heavy shipments due to arrive *ex* "Kanowna," and sales are being freely made at current rates. Bran.—Short on spot, at £6 5s. per ton. Pollard.—None procurable. Straw.—One truck was sold at auction at £3 5s. per ton.

PERTH FRUIT AND PRODUCE EXCHANGE REPORT.

The Perth Fruit and Produce Exchange report:—The market is very bare, and prices range high. We sold imported apples, Sturmers, 9s. 6d. to 10s. 6d.; Stone Pippins, 9s. 6d. to 10s. 3d.; French Crabs, 9s. 6d. to 10s.; good coloured lines, 12s. 6d. to 13s. 6d. Local lines are nearly done; prime are worth 12s. to 14s. 6d.; medium, 8s. to 10s. Oranges are very scarce; prime locals, 13s. to 14s. 6d.; medium, 10s. to 12s.; small samples, from 8s.; prime imported, 12s. 6d. to 14s.; medium stuff, 9s. to 11s. Lemons in good demand; prime, 5s. 6d. to 7s.; medium, 4s. Citronelles, 2s. Local pomeloes, 3s. 6d. to 4s. doz. Cape gooseberries, 3½d. to 4½d. Passion fruit, 14s. to 16s.; small cases, 7s. to 9s. Loquats, 8s. to 9s.; medium, 6s.; small cases, 3s. to 4s. Medium samples bananas, 16s. to 18s.; inferior, 10s. to 12s. We had enormous quantities of garden produce forward, consisting very largely of peas and small samples of local

potatoes, which accounted for a drop in cabbage, etc., this morning. However we cleared all lines at satisfactory prices. Prime cabbage, 15s. to 18s. 6d. per cwt.; medium, 10s. to 14s.; savoy, 8s. to 14s. cwt.; a lot of inferior stuff sold from 7s. bag. Cauliflowers, prime, 8s. to 10s.; medium, 5s. to 7s. 6d.; small, from 2s. doz. We sold about two tons peas, from 1½d. to 2½d. Broad beans, 1d. to 1¾d. French beans, 6d. to 7d. Chillies, 7d. to 9d. Rhubarb 2¾d., 3¼d. Horse-radish, 7d. Artichokes, 2½d. Brussels sprouts, 4d. Lettuce, 1s. 6d. to 4s. bag. Spring onions, 6d. to 7d. Radishes, 3d. to 6d. Leeks, 6d. to 1s. Chinese turnips, 1s. to 2s. 1d. Carrots, 1s. 3d. to 1s. 10d. Turnips, 1s. to 1s. 6d. Parsnips, 2s. to 2s. 5d. Beetroot, 1s. 7d. to 2s. 1d. Swedes, 1s. 6d. to 2s. doz.; 5s. 6d. to 6s. 9d. cwt. loose. Ironbark pumkins, 6s. 6d. to 7s. 9d.; bugles, 6s. to 7s. cwt. Imported onions, 18s. to 20s.; local silver-skins, 25s. 6d. cwt. Local potatoes: Heavily supplied, and much easier to-day; no prime lines offering; medium, 12s. 6d. to 16s. cwt.; imported Tasmanians, 12s. 3d. cwt. Herbs, 1s. 6d. to 2s. case. Mint, parsley, and watercress, 1s. 6d. to 3s. doz. bunches. Other lines at usual prices. Fresh laid eggs, 1s.; country, 10d.; duck eggs, 1s. 3d. to 1s. 4d. Poultry: Fair supplies offering, but no demand. Prime lines sold at low rates. Fresh butter, 1s. 3½d. Pork, 4d.

Messrs. JOHN M. HOPKINS & Co.'s REPORT.

Messrs. John M. Hopkins and Co. report:—We sold on account of the Westralian Estates and Timber Co., Ltd., two farms in the Dardanup subdivision of their South-Western agricultural estates at £10 and £11 10s. per acre respectively. During the past week the demand for all classes of horses has been fairly well sustained. At the W.A. Stock Bazaar we sold good delivery sorts to £30, draughts to £49, useful buggy mares to £17, better to £25, and up to £30 for superior sorts. Ponies have been more difficult to place, owing to supply being unusually heavy. Good upstanding mares are in strong demand, whilst active delivery sorts are eagerly inquired for. Chaff we quote wholesale, of best quality, at £6 10s.; West Australian flour, of best quality, £8 15s. Cattle: We sold one line of cows with calves at foot, delivery at Murchison, at £5 per head. Demand for heifers unsupplied.

Messrs. PIESSE, LOWE, & CO.'S REPORT.

Messrs. Piesse, Lowe, & Co. report:—Fruit: Large supplies of oranges to hand but no local apples, which are practically done. Best oranges, 10s. to 11s. 3d.; inferior, 7s. to 9s. Washington Navels: Some good lines from the Kalamunda district made 13s. 6d. to 15s., medium quality making from 10s. to 11s. 9d. Loquats, best, from 10s. to 13s.; medium and others, 7s. 6d. to 9s. Passion fruit, 16s. to 16s. 9d. Cape gooseberries, 3d. to 3¾d. Apples, imported, Sturmers, 8s. 6d. to 9s.; Rokewoods, 9s. to 11s. Lemons, best, 7s. 6d. to 9s. 6d.; others, 6s. upwards. We would still advise clients to unload their stocks of lemons, as the first shipment of Italians is due to arrive about the second week in November, and it would be well to be quit of all local stocks before these are placed upon the market. Vegetables: Our rooms were filled to their utmost capacity. Very large supplies of both cabbage and peas, in addition to bunched vegetables, to hand, and prices eased somewhat all round. Prime cabbage, £15 to £19; medium, £9 to £11; inferior, from £3 upwards; red cabbage, £7 to £9. Swedes: Large supplies, and prices somewhat easier; best, £5 to £7. Pumpkins: No prime lines on offer; best, £7 10s. to £9 for ironbark; bugles, £5 to £6 5s. New potatoes: Owing to the fairly regular consignments now coming to hand prices eased somewhat; best £15 to £17 10s.; medium, £11 to £12 10s. Peas: Several tons forward, and prices eased considerably; best, 2d. to 2¼d.; others, 1d. to 1½d. Broad beans, 1½d. to 2½d. Rhubarb, best, 2¾d. to 3½d.; others, 1½d. to 2¼d. Beetroot, best, 1s. 3d. to 2s. 2d.; others, 4d. upwards. Parsnips, 1s. 6d. to 2s. 6d. Carrots, 9d. to 1s. 7d. Turnips, best, 9d. to 1s. 1d.; inferior, from 3d. upwards. Swedes, 10d. to 1s. 8d. Celery, medium, 1s. 3d. to 2s.; others, from 4d. upwards. Spring onions, 3d. to 10d. Lettuce, best, 2s. 6d. to 4s. per bag; others, from 1s. upwards. Silver-skin onions, 24s. to 30s. Asparagus, 11d. Cauliflowers: Very heavy consignments still coming to hand; prices eased considerably; best. 7s. 6d. to 9s.; medium, 2s. to 5s. 9d.; others, from 5s. upwards. Poultry: Good supplies to hand, and quality good, best fowls making up to 7s. 6d.; others, 6s. to 7s.; smaller, 3s. 6d. to 5s.; chickens, young, from 1s. 5d. Ducks, best, from 6s. 3d.; other lots, 5s. to 6s. Turkeys, small, from 15s. to 18s. Eggs, 10d. to 1s. 2d. Local butter, 12½d. to 1s. 1d.

Mr. STANLEY C. SUTTON'S REPORT.

Mr. Stanley C. Sutton reports:—Supplies forward continue to show increases in all lines, especially fruit, vegetables, and poultry. Encouraged by fine weather, buyers put in an appearance in large numbers, a. d both bidding and prices were excellent all round. Fruit: Large supplies, and demand good. Local apples: None to hand. Imported lines: Tasmanian Sturmers, 9s. to 10s.; Crabs, 9s. 6d.; Scarlets, from 12s. 6d. to 13s. 3d., and Royals 13s.; Stone Pippins, 10s. Oranges showed a full list, both local and imported, and prices steady. Best imported, 13s. to 14s. For prime local Navels we made up to 14s.; medium and seconds, 12s. to 13s. 3d.; others from 10s.; best packed ordinary, 9s. 6d. to 12s.; seconds, 8s. 6d. to 9s.; windfalls, from 6s. Lemons were better, and prime cases of smalls made up to 9s.; medium and large, from 6s. Passion fruit was slightly easier, best ripe lots making to 16s; mixed, from 11s. 6d. Loquats made to 9s. 6d. for best large ripe. Bananas were in demand at late rates; ripe crates to 23s. Cocoanuts to 3s. Singapore pomeloes, from 2s. 6d. Cape gooseberries sold well; large berries, to 4¼d., others from 2½d up. Vegetables: Heavy supplies, and values firm in most lines. Local potatoes went back a trifle on increased stocks arriving, and cabbage was weaker, owing to vegetables of other kinds being available. Good local potatoes, £14 to £15 10s.; extra prime to £17. Pumpkins, £6 10s. to £8 10s. Swedes, Cabbage, good average stuff, 11s. to 14s. per cwt.; very choice, up to 18s. Rhubarb, 2½d. to 3¼d. Peas, from 1¼d. to 2¾d. Poultry: Full supplies, but an absence of quality. Prime table cockerels sold up to 8s. 6d.; extra to 10s.; good and medium, 7s. to 7s. 6d.; hens, good, 5s. 3d. to 5s. 9d.; chickens, from 3s. 9d. Ducks much easier; best large, to 6s. 6d.; good birds, 5s. 3d. to 5s. 9d; ducklings, 3s. 6d. to 4s. Eggs: Market firm; favourites to 13½d. Carcase pork: Abundant supplies, but quality and dressing of bulk not up to buyers' requirements; extra choice to 5½d.; others, from 4½d.

PERTH FRUIT AND PRODUCE EXCHANGE REPORT.

The Perth Fruit and Produce Exchange report that business during the last month has been fairly brisk. Producers who have been fortunate enough to have stuff forward have been obtaining very high prices, which show every sign of continuing. Fruit still keeps scarce, nearly all lines offering being imported. We would advise holders of oranges and lemons to forward now and obtain the benefit of high prices before the Italian supplies come in. The supply of vegetables has only been moderate, and not equal to the demand, consequently all lines have realised good prices. Growers will do well to steadily forward any lines they have for market, as there is no chance of the supply being greater than the demand. Fresh eggs have not moved since last report. Poultry is very slack; no prime lines have been offering for some time. The demand does not warrant sending in, in any quantity, at the present time.

H. J. WIGMORE & CO.'S REPORT.

For month ending 7th inst., we have to report as follows in connection with our daily auction sales of chaff and grain at Perth and Fremantle railway yards:—

The average arrivals per week for the month amount to about 90 trucks, being a decrease of about 10 trucks per week on the previous month. During the month £7, which is the highest price for the season, was obtained by us on 29th September for a truck of very prime green wheaten chaff from Greenhills. Since that date, owing partly to very heavy supplies (for instance, last week there were 130 trucks to hand), the market has quietly receded. Another factor contributing towards the lower prices has been the arrival daily at Perth of several trucks of imported chaff. All the larger Perth chaff merchants have now stocks of the imported article, which prevents them bidding freely in the open market. As a matter of fact, the position now is that unless the local article is either better or as cheap as the imported article the Perth buyers will not operate. The market closes as follows:—Prime green wheaten, £6 2s. 6d. to £6 7s. 6d., f.a.q.; wheaten, £5 17s. 6d. to £6; good medinm wheaten, £5 10s. to £5 15s; medium wheaten, £4 upwards, according to quality; cow chaff, £3 5s. upwards, according to quality. Prime oaten chaff (very scarce) is worth £6 10s., f.a.q.; oaten, £5 15s. to £6 5s.; medium qualities according to condition. The new season's chaff will probably be on the market well within a fortnight, when we anticipate cheaper prices. Owing to the near approach of the new season, we expect that no further purchases of imported chaff will be made, and only

shipments which have been shut out from previous boats will arrive. A speculator must be bold indeed to purchase chaff f.o.b. when the new season is so close. The Fremantle market during the month has remained in the same erratic condition. One day it is perhaps 5s. to 10s. higher than Perth, and the next day the reverse will be be the case, so that we cannot advise clients to consign to Fremantle unless they communicate with us beforehand.

Wheat.—During the month there has been a considerable easing in this commodity also; the price, which opened firm at 4s. 5d., has receded to 4s. 3½d. rails, Perth, and even at this figure only light sales are possible. This position has also been largely brought about by the fact that importers have purchased considerable stocks of cheaper wheat, which, of course, does well enough for poultry. We look forward to higher prices in the near future.

Oats.—Algerians have firmed considerably during the month, and Prime Heavies are now quoted at 2s. 2d. to 2s. 2½d., f.o.b., Melbourne. Prices are likely to go still higher before the Victorian harvest. Local Algerians have long since ceased to be a factor in the trade.

Flour.—We have little alteration to record since we last reported to this *Journal*. We have made very heavy sales during the month of Thomas' Northam Standard Flour at £8 5s. sacks, £8 10s. quarters, on rails, Northam, at which prices we are still prepared to do business. We quote exactly the same figures, f.o.b., Port Adelaide, for Thomas' Standard Flour.

Bran Bags and Cornsacks.—These Jute goods have risen considerably, and, so far as bran bags are concerned, farmers would be wise to communicate with us at once, as there appears every reason to anticipate a further increase in values. We hold heavy stocks, and are prepared to quote bedrock prices.

Kalgoorlie Branch.—We wish our farmer friends to note that we are opening a branch of our business at Kalgoorlie, on the 20th inst., under the management of Mr. R. Paton, who has lately been touring the farming districts in our interests. The same care and attention will be observed by our Kalgoorlie office as has been the case in the past with us at Perth and Fremantle.

THE CLIMATE OF WESTERN AUSTRALIA DURING SEPTEMBER, 1905.

The first half of the month was unusually stormy in South-Western and Southern districts, heavy gales and rain prevailed, with remarkably high seas, causing a delay of nearly 1½ days to the mail steamer "Victoria" between Adelaide and Fremantle. The wind reached a velocity of 60 miles per hour at the Observatory at 5·30 p.m. on the 11th. The total horizontal motion for the 24 hours was 673 miles on the 9th, 633 on the 10th, and 864 on the 11th. The weather remained showery until the 16th, after which it cleared, and was then remarkably fine and dry until the end of the month.

On the whole the rainfall was very much in excess of the average in the South-Western districts, but elsewhere it was light.

Pressure was everywhere about normal. Day temperature was also normal along the West coast, with rather cooler nights than usual; but throughout the remainder of the State the temperature was very much below the means for previous years. There were no severe frosts during the month, but the thermometer on the surface of the ground fell below 32° occasionally, the lowest reading recorded being 26° at Katanning.

The Climate of Western Australia during September, 1905.

Locality.		Barometer (corrected and reduced to sea-level). Mean of 9 a.m. and 3 p.m.	Average for previous years.	Highest for Month.	Lowest for Month.	Shade Temperatures. September, 1905. Mean Max.	Mean Min.	Mean of Month.	Highest Max.	Lowest Min.	Average for previous Years. Mean Max.	Mean Min.	Highest ever recorded.	Lowest ever recorded.	Rainfall. Points (100 to inch) in Month.	Wet Days.	Total Points since Jan. 1.
North-West and North Coast:	Wyndham	29·	29·956	30·222	29·920	96·5	79·8	88·2	104·0	73·0	94·5	74·6	103·5	65·0	*Nil*	...	1,081
	Derby	29·972	29·970	30·102	29·812	92·7	65·9	79·3	101·6	59·0	94·4	65·4	103·0	54·5	7	1	1,482
	Broome	29·983	29·980	30·111	29·861	85·6	66·3	72·0	94·8	58·5	88·6	65·0	101·0	54·5	81	1	690
	Condon	30·006	30·008	30·148	29·867	82·5	56·2	69·4	92·0	46·1	85·2	56·2	98·8	42·0	44	1	894
	Cossack	30·004	30·018	30·154	29·849	84·3	59·3	71·8	93·0	53·0	86·3	61·1	98·2	50·0	*Nil*	...	837
	Onslow	30·045	30·028	...	29·880	80·2	54·7	67·4	89·0	47·0	83·7	56·3	101·0	43·5	*Nil*	...	607
	Winning Pool ...	...	...	...	...	...	...	...	...	...	...	...	...	...	5	1	843
	Carnarvon	...	30·082	...	...	75·5	56·6	66·0	92·0	48·0	74·7	56·4	95·7	43·0	30	4	1,005
	Hamelin Pool... ...	30·065	30·074	30·270	29·730	75·0	52·0	63·5	89·0	44·0	76·9	51·6	96·8	40·0	62	8	868
	Geraldton	30·050	30·106	30·330	29·600	74·0	52·0	63·0	85·0	44·0	70·8	51·9	94·0	39·0	318	15	1,915
Inland:	Hall's Creek	...	29·996	...	...	...	...	...	...	...	93·2	60·1	100·4	42·2	...	...	...
	Marble Bar	...	...	...	...	87·5	59·3	73·4	94·2	51·0	92·1	60·3	101·7	42·0	4	2	890
	Nullagine	30·030	30·007	30·250	29·851	82·7	50·3	66·5	90·0	34·8	87·7	54·4	98·5	38·9	*Nil*	...	576
	Peak Hill	30·070	30·038	30·340	29·700	73·0	49·0	61·0	79·0	42·0	77·2	52·5	91·0	38·1	12	2	462
	Wiluna	30·057	30·002	30·339	29·640	71·5	44·7	58·1	78·5	33·7	76·4	49·1	93·8	34·6	3	2	536
	Cue	30·090	30·074	30·370	29·710	70·6	48·1	59·4	80·8	41·0	75·9	49·7	93·2	37·0	48	5	703
	Murgoo	...	...	...	...	72·6	49·2	60·9	84·5	40·0	...	...	...	...	45	4	517
	Yalgoo	30·062	30·076	30·354	29·590	71·2	47·9	59·6	82·8	41·0	74·6	47·3	93·6	35·7	135	7	959
	Lawlers	30·084	30·062	30·408	29·634	69·8	48·2	59·0	78·2	37·8	74·5	48·7	95·2	34·7	8	3	681
	Laverton	30·093	30·041	30·436	29·639	68·4	44·7	56·6	82·5	32·1	74·5	48·4	94·5	35·0	*Nil*	...	655
	Menzies	...	30·018	30·454	...	67·5	44·1	55·8	77·0	34·2	72·3	48·0	92·1	33·5	30	2	564
	Kanowna	...	...	...	...	66·4	43·0	54·7	77·0	36·2	...	...	...	...	49	8	514
	Kalgoorlie	30·080	30·076	30·491	29·626	66·8	44·5	55·6	77·8	37·8	71·2	48·2	90·8	34·9	41	7	489
	Coolgardie	30·072	30·075	30·495	29·550	65·6	42·9	54·2	74·2	36·0	70·9	46·7	92·0	35·0	70	6	584
	Southern Cross ...	30·084	30·062	30·455	29·548	67·0	41·8	54·4	75·2	32·5	71·3	44·0	95·0	31·0	85	6	566
	Kellerberrin	...	...	...	...	...	...	...	...	...	...	...	...	...	266	11	1,123
	Walebing	...	...	...	...	64·7	43·6	54·2	73·0	35·0	66·2	43·9	79·9	32·4	470	14	1,973
	Northam	...	...	...	...	65·8	43·5	54·6	75·0	35·0	67·7	45·1	80·6	32·8	481	14	1,929
	York	30·086	30·017	30·461	29·553	65·4	42·3	53·8	73·0	33·2	68·1	43·2	84·7	31·8	449	12	2,051
	Guildford	...	...	...	...	67·0	48·7	57·8	97·0	41·2	69·7	48·9	88·0	37·7	681	14	3,279

The Climate of Western Australia during September, 1905—*continued.*

Locality.	Barometer (corrected and reduced to sea-level). Mean of 9 a.m. and 3 p.m.	Average for previous years.	Highest for Month.	Lowest for Month.	Shade Temperatures. September, 1905. Mean Max.	Mean Min.	Mean of Month.	Highest Max.	Lowest Min.	Average for previous Years. Mean Max.	Mean Min.	Highest ever recorded.	Lowest ever recorded.	Rainfall. Points (100 to inch) in Month.	Wet Days.	Total Points since Jan. 1.
SOUTH-WEST AND SOUTH COAST:																
Perth Gardens	30·076	30·104	30·010	29·495	67·4	49·3	58·4	75·8	44·0	66·0	50·4	86·0	39·0	594	14	3,125
Perth Observatory ...	30·082	30·092	30·457	29·490	65·5	48·8	57·6	75·9	41·5	67·9	49·9	87·6	35·0	575	14	3,157
Fremantle	30·098	30·097	30·457	29·524	65·2	50·9	58·0	77·5	44·8	64·8	52·7	84·0	41·8	491	15	2,417
Rottnest	30·082	30·088	30·432	29·516	63·9	51·4	57·6	74·0	45·0	64·4	53·8	83·0	42·6	405	15	2,394
Mandurah	...	...	...	...	65·4	46·2	55·8	75·1	40·0	65·2	50·8	82·0	35·0	735	12	3,884
Marradong	...	...	...	...	...	...	...	...	...	...	...	...	...	627	11	3,018
Wandering	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Narrogin	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Collie	...	...	...	...	...	...	...	...	...	63·2	42·3	78·7	30·8	...	...	...
Donnybrook *	...	...	...	...	63·8	44·0	54·0	79·2	36·5	64·5	46·8	76·9	32·5	671	13	3,695
Bunbury	30·089	30·094	30·446	29·406	63·8	46·9	55·4	72·0	40·0	65·2	49·5	83·8	32·2	679	15	3,346
Busselton	...	...	...	...	64·1	44·8	54·4	72·2	38·0	64·0	48·0	78·8	34·2	552	16	2,800
Cape Naturaliste ...	30·067	...	30·439	29·321	60·5	48·6	54·6	66·6	46·0	...	...	...	...	345	13	2,649
Bridgetown	...	...	...	...	63·0	39·2	51·1	76·0	31·0	63·7	42·8	79·2	32·2	695	17	2,940
Karridale	...	30·080	30·450	29·470	63·0	43·0	53·0	75·0	33·0	63·3	48·7	82·5	31·5	722	19	4,189
Cape Leeuwin	...	30·027	30·450	29·030	61·0	51·0	56·0	72·0	44·0	62·6	53·6	79·5	43·8	533	19	3,460
Katanning	30·086	30·072	30·454	29·489	61·5	41·5	51·5	71·0	34·0	63·9	43·6	81·1	29·8	384	11	1,825
Mt. Barker	...	...	...	...	58·8	40·8	49·8	68·6	33·8	...	...	...	...	608	22	2,339
Albany	30·080	30·046	30·504	29·243	60·5	44·1	52·3	75·3	39·5	63·5	47·6	84·8	34·0	796	21	3,170
Breaksea...	30·055	30·034	30·540	29·220	57·0	46·0	51·5	68·0	37·0	61·2	50·6	84·2	40·0	748	20	3,035
Esperance	30·078	30·059	30·522	29·359	62·3	43·5	52·9	73·8	35·5	66·6	48·4	86·6	35·2	308	17	2,299
Balladonia	30·119	30·027	30·559	29·422	63·1	40·1	51·6	70·4	28·8	69·5	45·0	87·2	33·6	96	8	519
Eyre	30·083	30·070	30·508	29·419	63·8	43·4	53·6	78·3	29·1	67·9	46·9	90·2	31·3	86	8	659
INTERSTATE.																
Perth	30·082	30·104	30·457	29·490	65·5	48·8	57·6	75·9	41·5	66·0	50·4	86·0	39·0	575	14	3,157
Adelaide	30·062	30·071	30·444	29·517	60·5	43·5	52·0	75·1	35·9	66·5	47·9	90·7	32·7	157	17	1,937
Melbourne	...	29·922	...	...	...	...	...	...	...	62·6	45·4	81·8	32·1	262	19	2,070
Sydney	...	30·045	30·480	...	64·0	47·0	55·5	74·0	41·0	66·3	51·4	89·8	40·8	250	8	2,936

* Averages for three years only.

The Observatory, Perth, 9th September, 1905.

W. E. COOKE, Government Astronomer.

RAINFALL for August, 1905 (completed as far as possible), and for September, 1905 (principally from Telegraphic Reports).

Stations.	August. No. of points. 100 = 1in.	August. No. of wet days.	September. No. of points. 100 = 1in.	September. No. of wet days.
East Kimberley				
Wyndham ...	1	1	Nil	...
6-Mile	...	...	...	...
The Stud Station	...	...	...	...
Carlton	Nil	...	...	...
Denham	...	...	...	...
Rosewood Downs	...	...	...	...
Argyle Downs ...	...	...	...	...
Lisadell	..	...	...	...
Turkey Creek ...	74	4	9	1
Ord River ...	Nil	...	...	...
Alice Downs ...	18	3	...	...
Hall's Creek ...	Nil	...	13	1
Nicholson Plains	...	...	...	...
Flora Valley ...	Nil	...	...	...
Ruby Plains ...	...	...	...	..
Denison Downs...	...	...	...	...
West Kimberley:				
Obagama ...	...	...	...	...
Beagle Bay ...	..	...	...	...
Pt. Torment ...	157	1	...	...
Derby	70	2	7	1
Yeeda	48	1	...	...
Liveringa ...	...	...	...	...
Mt. Anderson ...	...	...	...	...
Leopold Downs...	Nil	...	...	...
Fitzroy Crossing	Nil	...	Nil	...
Fitzroy (C. Blythe)	Nil	...	...	...
Quanbun ...	Nil	...	...	...
Nookanbah ...	...	...	...	...
Broome	52	1	81	1
Roebuck Downs	65	1	...	...
Thangoo... ...	...	...	...	...
La Grange Bay...	60	1	51	4
North-West:				
Wallal	75	1	64	3
Condon	176	1	44	1
Pardoo	121	1	...	...
DeGrey River ...	127	1	...	...
North-West—*cont.*				
Port Hedland ...	163	2	37	1
Boodarie ...	153	2	...	...
Warralong ...	120	1	...	...
Muccan	...	...	...	...
Ettrick	...	...	...	...
Mulgie	...	...	...	...
Eel Creek ...	...	...	...	...
Station Peak ...	36	1	...	...
Coongon... ...	123	1	...	...
Warrawagine ...	171	1	...	...
Bamboo Creek ...	112	1	18	2
Marble Bar ...	81	2	4	2
Warrawoona ...	92	1	1	1
Corunna Downs...	...	...	...	...
Nullagine ...	108	1	Nil	...
Mt. Edgar ...	...	...	...	...
Kerdiadary ...	35	1	...	...
Roy Hill... ...	...	...	...	...
Middle Creek ...	...	...	...	...
Mosquito Creek...	85	1	...	...
Mulga Downs ...	Nil	...	...	...
Woodstock ...	88	1	...	...
Mt. Florence ...	...	...	...	...
Tambrey ...	Nil	...	...	...
Millstream ...	9	1	...	...
Yandyarra ...	...	...	...	...
Mallina	69	1	...	...
Whim Creek ...	24	2	5	1
Cooyapooya ...	Nil	...	...	...
Woodbrooke ...	Nil	...	...	...
Croydon	5	1	...	...
Balla Balla ...	...	...	...	...
Roebourne ...	2	1	1	1
Cossack	2	1	Ni	...
Sherlock ...	Nil	...	...	...
Fortescue ...	21	2	Nil	...
Mardie	...	...	...	...
Mt. Stewart ...	...	...	...	...
Yarraloola ...	...	...	...	...
Chinginarra ...	...	...	...	...
Onslow... ...	23	2	Nil	...
Peedamullah ...	2	2	...	...
Red Hill	...	...	...	...
Mt. Mortimer ...	Nil	...	...	...
Peake Station ...	Nil	...	...	...
Wogoola ...	...	...	...	...

RAINFALL—*continued.*

Stations.	August. No. of points. 100 = 1in.	August. No. of wet days.	September. No. of points. 100 = 1in.	September. No. of wet days.
North-West—*cont.*				
Nanutarra ...	Nil	...	...	...
Yanrey ...	51	2	...	...
Point Cloates ...	...	...	...	...
Edmunds ...	...	...	...	...
Gascoyne:				
Winning Pool ...	24	2	5	1
Coordalia ...	...	...	...	...
Towara ...	35	1	...	...
Ullawarra ...	...	...	...	...
Maroonah ...	...	...	...	...
Gifford Creek ...	...	...	...	...
Thomas Police Station	...	...	...	...
Bangemall ...	...	...	...	...
Mt. Augustus ...	...	...	...	...
Minnie Creek ...	9	2	...	...
Yanyeareddy ...	...	...	...	...
Williambury ...	...	...	...	...
Booloogooroo ...	...	...	...	...
Wandagee ...	...	...	...	...
Bernier Island ...	...	...	...	...
Boolathana ...	10	1	...	...
Carnarvon ...	23	4	30	4
Brick House ...	7	1	...	...
Doorawarrah ...	6	2	...	...
Bintholya ...	...	...	...	...
Mungarra ...	Nil	...	...	...
Clifton Downs ...	...	...	...	...
Dairy Creek ...	30	2	...	...
Upper Clifton Downs	...	...	...	...
Dirk Hartog Island	124	10	230	11
Sharks Bay ...	18	3	...	...
Kararang ...	99	6	...	...
Meedo ...	25	2	...	...
Tamala ...	144	9	...	...
Wooramel ...	12	1	77	5
Hamelin Pool ...	57	6	62	8
Byro ...	12	1	...	...
Yarra Yarra ...	31	3	...	...
Berringarra ...	...	...	...	...
Mt. Gould ...	...	...	...	...
Moorarie ...	22	2	...	...
Wandary ...	...	...	...	...
Peak Hill ...	8	1	12	2
Mt. Fraser ...	...	...	...	...

Stations.	August. No. of points. 100 = 1in.	August. No. of wet days.	September. No. of points. 100 = 1in.	September. No. of wet days.
Gascoyne—*contd.*				
Abbotts ...	17	2	Nil	...
Belele ...	...	...	...	...
Mileura ...	77	3	...	...
Milly Milly ...	64	2	...	...
Manfred ...	34	4	...	...
New Forest ...	53	4	...	...
Woogorong ...	...	...	...	...
Boolardy ...	...	...	...	...
Twin Peaks ...	33	1	...	...
Billabalong ...	Nil	...	...	..
Wooleane ...	57	4	...	...
Woolgorong ...	49	4	...	...
Murgoo ...	49	4	45	4
Yallalonga ...	91	5	...	...
Meka ...	68	3	...	...
Mt. Wittenoom ...	41	3	...	...
Nannine ...	54	2	20	3
Star of the East...	60	3	...	...
Annean ...	...	...	...	...
Tuckanarra ...	47	3	...	...
Coodardy ...	32	3	...	...
Cue ...	56	4	48	5
Day Dawn ...	51	4	28	3
Lake Austin ...	53	2	49	2
Lennonville ...	43	2	48	5
Mt. Magnet ...	39	2	39	4
Challa ...	66	2	...	...
Youeragabbie ...	...	...	...	...
Black Range ...	76	2	...	...
Murrum ...	73	1	...	...
Burnerbinmah ...	80	6	...	...
Barnong ...	76	5	...	...
Mellenbye ...	128	8	...	...
Yalgoo ...	64	3	135	7
Wagga Wagga ...	66	2	...	...
Gabyon ...	78	4	...	...
Tallyrang ...	70	4	...	...
Gullewa ...	179	4	128	6
Muralgarra ...	87	4	106	5
Wydgee ...	80	3	...	...
Wearagaminda...	66	7	...	...
Gullewa House ...	97	8	...	...
South-West Division (Northern Part):				
Murchison House	192	8	...	...
Mt. View ...	110	6	...	...

RAINFALL—*continued.*

Stations.	August. No. of points. 100 = 1in.	August. No. of wet days.	September. No. of points. 100 = 1in.	September. No. of wet days.
South-West (Northern)—*contd.*				
Mumby	303	11	...	...
Yuin	47	4	...	...
Northampton	383	12	631	13
Oakabella	...	...	...	...
Narra Tarra	...	...	...	...
Tibradden	262	12	490	15
Myaree	295	10	...	...
Sand Springs	...	...	...	...
Mullewa	172	9	251	14
Kockatea	180	8	...	...
Chapman Experimental Farm	...	...	425	13
Bootenal	...	...	...	...
Geraldton	197	12	318	15
White Peak	171	6	...	...
Greenough	121	8	340	10
Bokara	163	12	350	15
Dongara	130	7	344	13
Brookman's Hills	...	...	...	...
Strawberry	294	11	374	15
Nangetty	184	7	...	...
Mingenew	253	11	272	15
Urella	194	13	219	13
Yandenooka	198	10	...	...
Rothesay	...	...	...	...
Ninghan	63	4	...	...
Field's Find	37	3	84	7
Condingnow	...	...	...	...
Carnamah	149	8	305	11
Watheroo	165	11	270	14
Dandaragan	236	14	561	13
Moora	155	11	366	11
Yatheroo	251	11	...	...
Walebing	201	13	470	14
Round Hill	144	13	437	13
New Norcia	265	12	405	15
Wannamel	338	11	487	12
South-Western Division, Central (Coastal):				
Gingin	526	12	589	10
Belvoir	494	11	699	14
Mundaring	552	11	...	...
Wandu	435	16	658	16
Guildford	382	11	681	14
Kalbyamba	457	10	588	12
Canning W't'r'w'ks	305	7	752	14

Stations.	August. No. of points. 100 = 1in.	August. No. of wet days.	September. No. of points. 100 = 1in.	September. No. of wet days.
South-West (Coastal)—*contd.*				
Perth Gardens	349	12	594	14
Perth Observatory	350	16	575	14
Subiaco	346	13	552	14
Claremont	310	9	...	...
Wanneroo	522	12	692	13
Jandakot	470	10	685	13
Fremantle	332	13	491	15
Rottnest	295	15	405	15
Armadale	504	16	...	...
Rockingham	227	12	426	12
Jarrahdale (Norie)	134	13	...	...
Jarrahdale	590	15	908	15
Serpentine	397	17	750	15
Mandurah	468	12	735	12
Pinjarra (Blythewood)	364	13	695	15
Pinjarra	415	10	617	13
Yarloop	422	14	...	...
Harvey	354	15	678	16
Upper Murray	479	15	831	14
South-West, Central Part (Inland):				
Hatherley	246	11	...	...
Dowerin	125	6	...	...
Momberkine	308	8	256	8
Monglin	...	...	...	...
Warramuggin	243	8	...	...
Newcastle	326	9	540	13
Emungin	141	12	...	...
Eumalga	325	10	...	...
Eadine	...	...	...	...
Northam	256	11	481	14
Grass Valley	180	7	369	12
Meckering	177	7	243	9
Cunderdin	126	7	...	...
Codg-Codgen	104	7	...	...
Yarragin	107	5	...	...
Doongin	110	7	...	...
Whitehaven	229	4	...	...
Cutenning	137	9	224	11
Cardonia	100	6	...	...
Sunset Hills	221	11	405	12
Jelcobine	179	8	587	14
Cobham	291	12	490	14
Yenelin	169	6	...	...
Mt. Caroline	139	7	...	...

RAINFALL—*continued.*

Stations.	August. No. of points. 100 = 1in.	August. No. of wet days.	September. No. of points. 100 = 1in.	September. No. of wet days.
South-West (Central)—*contd.*				
York	248	12	449	12
Dalebridge	253	7	364	10
Beverley	307	8	450	9
Bally Bally	299	10	...	...
Oakdale	253	10	469	14
Barrington	201	9	...	...
Qualin	253	6	...	...
Stock Hill	194	7	...	...
Sunning Hill	200	10	582	13
Brookton	194	9	409	10
Wandering	303	8	757	10
Glen Ern	210	11	...	...
Pingelly	225	6	521	10
Yornan	155	8	498	14
Marradong	346	10	628	11
Wardering	139	8	421	13
Bannister	300	10	...	...
Wonnaminta	179	14	450	15
Narrogin	169	10	420	12
Narrogin State Farm	187	11	...	...
Wickepin	168	13	...	...
Gillimaning	144	8	...	...
Bunking	130	3	...	...
Bullock Hills	160	11	...	...
Bullingarra	...	...	...	...
South-West Division (Southern Part):				
Bunbury	303	11	679	15
Brunswick	315	8	467	9
Collie	309	13	873	16
Glen Mervyn	224	10	640	12
Donnybrook	345	13	671	13
Boyanup	275	15	633	10
Ferndale	559	11	409	10
Busselton	234	6	552	16
Quindalup	368	18	...	...
Cape Naturaliste	315	19	346	13
Glen Lossie	403	19	417	13
Lower Blackwood	262	17	622	13
Karridale	389	25	722	19
Cape Leeuwin	319	21	533	19
Biddellia	577	15	...	...

Stations.	August. No. of points. 100 = 1in.	August. No. of wet days.	September. No. of points. 100 = 1in.	September. No. of wet days.
South-West—(Southern)—*cont.*				
The Warren	505	17	437	13
Lake Muir	365	14	611	16
The Peninsula	...	...	...	...
Mordalup	245	12	...	...
Deeside	365	18	...	...
Riverside	397	14	...	...
Balbarup	396	12	569	11
Wilgarup	360	16	710	14
Cundinup	165	8	...	...
Bridgetown	332	17	695	17
Westbourne	301	15	...	...
Hilton	184	6	...	...
Greenbushes	311	9	885	11
Greenfields	230	13	...	...
Glenorchy	411	9	...	...
Williams	221	9	458	11
Arthur	167	7	466	9
Rifle Downs	184	9	...	...
Darkan	178	6	...	...
Wagin	219	11	504	11
Glencove	165	10	398	11
Dyliabing	176	11	...	...
Katanning	156	12	384	11
Kojonup	241	11	618	11
Broomehill	138	12	409	12
Woolagarup	110	12	348	11
Sunnyside	159	15	427	14
Talbot House	263	11	417	10
Woodyarrup	137	10	361	13
Mianelup	104	10	286	14
Cranbrook	163	10	...	...
Toolbrunup	130	10	360	14
Tambellup	241	11	274	14
Blackwattle	184	5	...	...
Woogenellup	183	15	...	...
Mt. Barker	223	14	608	22
Kendenup	234	16	554	16
St. Werburgh's	241	16	...	...
Forest Hill	326	18	...	...
Wilson's Inlet	430	19	546	18
Denmark	...	...	...	...
Grasmere	427	19	...	...
Albany	495	22	796	21
King River	455	15	628	17
Point King	454	18	722	19
Breaksea	362	23	748	20
Cape Riche	154	9	...	...
Cherilallup	215	10	...	...
Pallinup	135	9	360	13

RAINFALL—*continued.*

Stations.	August. No. of points. 100 = 1in.	August. No. of wet days.	September. No. of points. 100 = 1in.	September. No. of wet days.
SOUTH-WEST— (Southern)—*cont.*				
Bremer Bay	160	12	472	16
Peppermint Grove	202	12	...	...
Jarramongup	220	14	...	...
Chillinup	42	1	...	...
EASTERN DIVISION:				
Dural	16	1	...	...
Wiluna	10	1	3	2
Gum Creek	Nil	...	Nil	...
Mt. Sir Samuel	5	1	Nil	...
Lawlers	62	4	8	5
Leinster G.M.	...	...	...	...
Darda	6	1	...	...
Lake Darlôt	...	...	...	...
Duketon	...	...	...	...
Salt Soak	4	1	...	...
Mt. Leonora	47	3	20	3
Mt. Malcolm	40	3	10	1
Mt. Morgans	15	1	Nil	...
Burtville	...	...	...	...
Laverton	13	2	Nil	...
Murrin Murrin	18	2	Nil	...
Yundamindera	40	3	2	1
Tampa	38	2	...	...
Kookynie	63	3	9	2
Niagara	57	3	Nil	...
Yerilla	39	3	...	...
Quandinnie	20	1	...	...
Edjudina	39	4	...	...
Menzies	81	2	30	2
Mulline	40	2	49	4
Waverley	...	...	...	...
Goongarrie	45	3	41	4
Mulwarrie	41	2	43	4
Bardoc	47	...	19	5
Broad Arrow	47	2	45	7
Kurnalpi	39	3	33	3
Bulong	79	4	65	5
Kanowna	55	4	49	8
Kalgoorlie	52	5	41	7
Coolgardie	54	4	70	6
Burbanks	90	4	78	7
Woolubar	83	4	...	...
Widgiemooltha	71	5	65	8
50-Mile Tank	38	3	...	...
Waterdale	123	5	...	...

Stations.	August. No. of points. 100 = 1in.	August. No. of wet days.	September. No. of points. 100 = 1in.	September. No. of wet days.
EASTERN—*contd.*				
Norseman	49	4	74	7
Lake View	61	5	...	...
Bulla Bulling	50	3	50	4
Boondi	61	4	61	8
Boorabbin	55	4	81	6
Koorarawalyee	73	2	122	9
Karalee	45	2	107	5
Yellowdine	43	2	86	5
Southern Cross	45	3	85	6
Parker's Range	73	8	146	14
Parker's Road	55	3	...	...
Mt. Jackson	54	4	69	5
Bodallin	58	5	...	...
Glen Elg Rocks	...	...	232	18
Burracoppin	...	...	...	...
Baandee	158	7	181	7
Kellerberrin	119	10	266	11
Merredin	106	7	179	10
Nangeenan	108	5	206	8
Mangowine	84	6	...	...
Wattoning	...	...	...	...
Noongarin	81	5	...	...
EUCLA DIVISION:				
Ravensthorpe	140	11	156	9
Coconarup	128	11	...	...
Hopetoun	155	9	119	8
Fanny's Cove	274	9	...	...
Park Farm	289	13	...	...
Esperance	330	14	308	17
Gibson's Soak	179	10	...	...
30-Mile Condenser	126	9	...	...
Swan Lagoon	118	8	...	...
Grass Patch	117	5	...	...
Myrup	298	13	...	...
Lynburn	232	16	...	...
Boyatup	266	13	...	...
Middle Island	305	10	...	...
Point Malcolm	183	14	...	...
Israelite Bay	114	11	313	17
Balbinia	94	7	103	11
Frazer Range	77	2	...	...
Balladonia	37	4	96	8
Southern Hills	93	2	...	...
Eyre	49	7	86	8
Mundrabillia	41	8	...	...
Eucla	72	8	52	10

The Observatory, Perth,
5th October, 1905.

W. E. COOKE,
Government Astronomer.

By Authority: A. CURTIS, Acting Government Printer, Perth.

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EDITOR'S NOTES.

LARGE BUTTER OUTPUT.—The output of Foley's Cootamundra Butter Factory during September was 13 tons 8cwt. 1qr. 19lb. butter. Suppliers were paid £1,316 11s. 1d., at the rate of 10d. and 10¼d. per lb.; other grades according to quality. During the month 500 boxes were sent to London, representing 28,000lb. net.

HONEY MARKET.—No town in the world imports more honey than Hamburg. In 1891 the importation was 8,300,000 pounds, at an average price of 6d. per pound. Since then it has gradually increased, the last returns showing a total import for 12 months of 12,750,000 pounds, at an average price of 6½d. per pound.

ROYAL SHOW.—The committee of the Royal Agricultural Show are to be congratulated at the unqualified success of the attendance at its recent show. The new grounds are all that could be desired, and, while the exhibits of stock and produce were very good, the absence of farm machinery was very noticeable. A thrasher, farm motor, a few pumps and windmills, seemed to be the only exhibits in this line.

RUBBER INDUSTRY.—Great activity is being displayed in the planting of rubber trees. In Ceylon, New Guinea, Central Africa, Mexico, the Philippines, and all tropical and sub-tropical countries, plantations are being laid out, and hundreds of thousands of trees are being planted. In Ceylon alone 4,000,00 seeds were sold this year at a penny each. A good tree will average 3lbs. of latex. It is estimated that an additional yield of 60,000 tons per annum would fall short of present requirements, so that at least 44,800,000 more trees will have to come into bearing in order to supply requirements.

Points in Ayrshires.—Breeders of Ayrshire cattle, particularly those who have selected that type for their dairy herds, will be pleased to learn that at the last annual meeting of the Ayrshire Herd-book Society the question of the smallness of the teats—the one defect in the Ayrshire cow—was taken into consideration, and it was decided that, in judging at shows, greater consideration should be given to this defect, and that the fleshy milk vessels should be discounted. A pronouncement of this kind cannot fail to produce a good effect upon breeders, and indeed it was stated that an advance in the direction indicated had already taken place.

New Orchards.—Those intending to plant fresh orchards or vineyards next winter cannot do better than by at once making a start to clear the land, and, where possible, plough and let it lay fallow. If ploughed now, say six inches, then the work of subsoil ploughing just before planting can be done easier and cheaper. In the case where it is intended to use cultivated land, then a good heavy sowing of some legumes for green manuring will prove of great value. Any ground that has been cleared and ploughed will be found to be much better for young trees than virgin ground worked for the first time, when the trees are planted.

English Agricultural Returns.—The statement of the acreage and live stock returns, issued by the Board of Agriculture, England, shows that 32,286,832 acres are now under crop, being a decrease of 30,778 as compared with 1904. In live stock, however, an increase is shown in agricultural horses, cattle, and sheep, and a decrease in swine, the figures being—

	1905.	1904.	Increase.	Decrease.
Horses ...	1,572,433 ...	1,560,236 ...	12,197 ...	—
Cattle ...	6,987,020 ...	6,858,352 ...	128,668 ...	—
Sheep ...	25,257,196 ...	25,207,178 ...	50,018 ...	—
Swine ...	2,424,919 ...	2,861,644 ...	... ...	436,725

Temperature of the Soil.—A number of useful experiments has just been completed to find out the difference of the temperature on cultivated and uncultivated soils. The observations showed that ploughing and mellowing promoted a more rapid exchange of heat in the soil. The heating, as well as the cooling, of the ploughed and mellowed soil was considerably greater than that of unploughed soil, the difference between the mean temperatures of the two during the summer weather reaching two degrees, and between the extreme maximum temperatures, five and more degrees. On the other hand, the minimum temperatures were lower on ploughed soil than on unploughed by almost one degree.

Composition of Lucerne.—The composition of the lucerne plant, revealed by chemical analyses, shows that it ranks among the best animal food-stuffs. When the plant was coming into bloom the analyses showed that it contained the following percentages:—Protein, 18·47; fat, 1·14; carbo-hydrates, 64·04; water, 4·40; ash, 11·95. It may be stated that the value of the feeding stuff is measured by the quantity of protein, and that an increase in carbo-hydrates generally indicates a deterioration in its feeding quality. Bran analysis, compared with that of lucerne, shows that lucerne is the more valuable as a fodder, its constituents being: Protein, 15·4; fat, 4·0; carbo-hydrates, 62·9; water, 11·9; ash, 5·8.

Dairy Cows for Japan.—Several agents of the Mikado's Government have been travelling through Wisconsin, United States, of late, selecting Jersey cattle for their country. In their opinion Jerseys are best adapted to the climate and conditions of Japan. They are thoroughly posted in the study of dairy cattle, and particularly so as regards the selection of only healthy specimens. To this end they are testing every animal with tuberculin, and thus show that they are much better informed on tuberculosis than many other buyers. They came provided with their own testing apparatus, and insisted on the use of their own Japanese tuberculin. Those with whom they came in contact were surprised to find them so well informed in veterinary science, and the use of the tuberculin test.

Swine Disease.—A very serious and fatal epidemic recently broke out amongst pigs in Cambridgeshire, England. It is stated to be "swine erysipelas." The disease is rapidly spreading to the adjoining districts, and threatens to become as serious as that of "swine fever," so prevalent a short time back. For some time local veterinary surgeons were at a loss as to the nature of the disease, but that point has now been settled. The disease is common in Germany and France, where it is successfully combated by using "Leclainche's" (Pasteur Institute) anti-rouget vaccine and serum. Pig-owners should, therefore, get their veterinary surgeons to obtain and inoculate their pigs with this product. The *serum* is used in an infected sty, and after a certain time the *vaccine* is used. Where the disease does not exist the *vaccine* alone may be inoculated.

Lamb Raising.—One of the best crosses, if not the very best cross that can be made for lamb raising in this State, is that from a merino ewe and Shropshire ram; the crossbred ewe being mated to a merino ram. A diagram of this cross is here reproduced:—

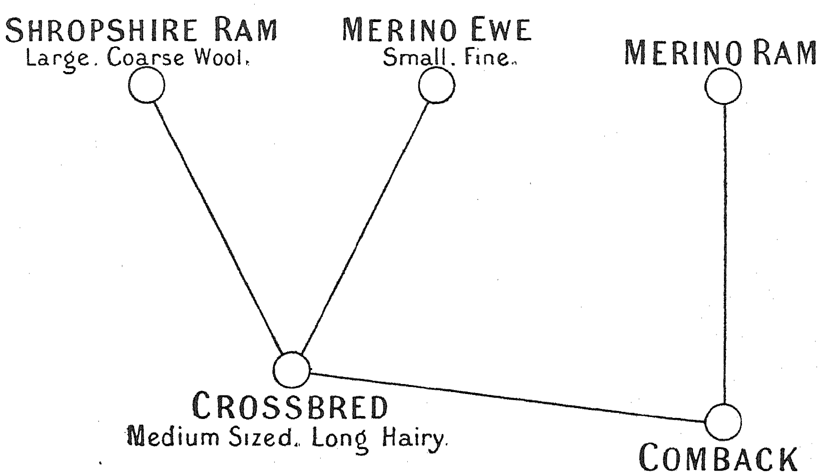


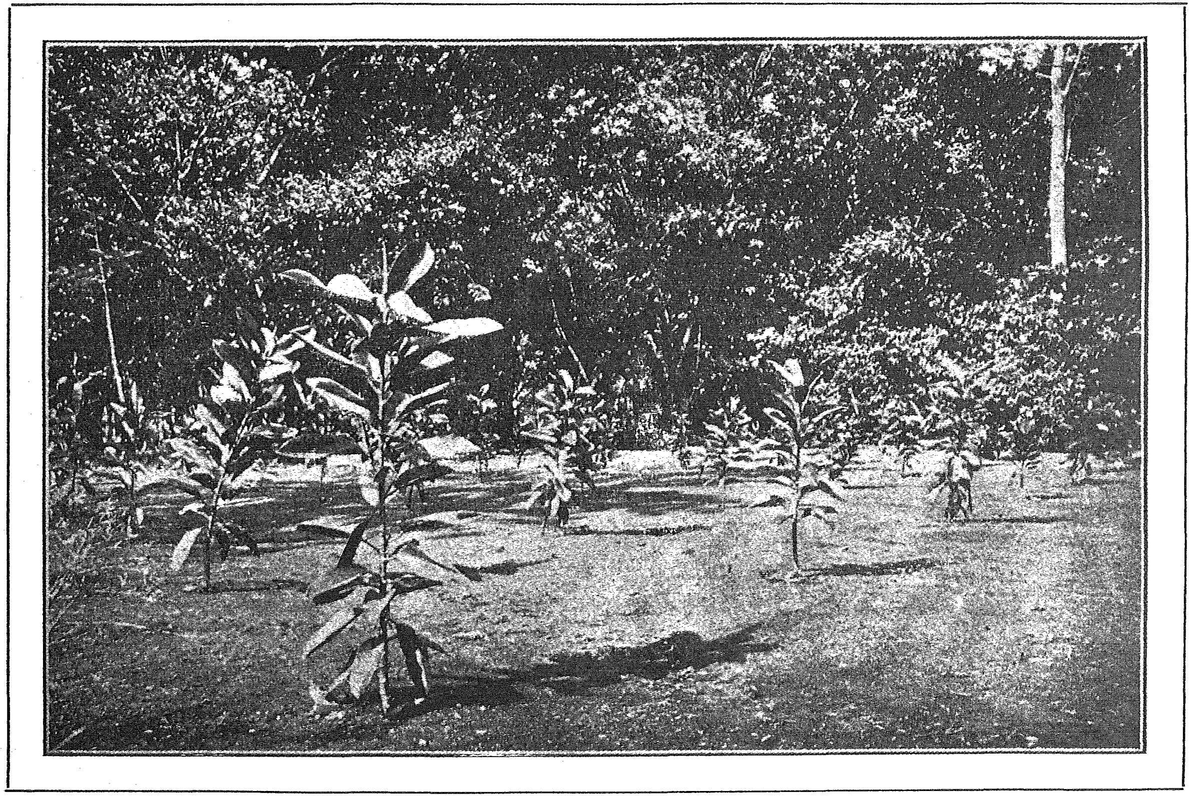
Diagram showing best cross for lambs for market.

This produces a cross that is unequalled for early market, and produces the best carcase for cold-storage and export.

Australian Wine in England.—Mr. Burgoyne estimates the increase in the quantity of wine imported into England from Australia this year at 107,975 gallons over the previous year, and he has told a London newspaper interviewer that he regards this increase as showing how the continuous efforts of Australian vignerons to grow the right quality of grapes and manufacture a sound wine are meeting with the success they merit. Mr. Burgoyne points out that while the consumption of Australian wine is increasing, that of French wine is decreasing yearly, as shown by the following figures:—1896, 6,736,718 gallons; 1900, 5,382,701 gallons; 1901, 5,517,828 gallons; 1902, 5,260,000 gallons; 1903, 5,098,996 gallons; 1904, 3,714,350 gallons. Mr. Burgoyne concludes his remarks with the following sentence:—"I think Australia will make more money out of her vineyards than ever she will out of her goldfields."

Price of Poultry.—Several letters have appeared in the daily papers during the last few days. The general complaint appears to be the very low price obtainable for poultry, not enough, as one writer puts it, to pay for the feed the bird consumes; yet, on the other hand, the customer is unable to buy a bird from the retailers at anything below what might be termed an almost prohibitive price. The following extract from one of the letters referred to explains the position:—"Shops in Perth do not sell cheap poultry, if they buy it cheap. There seems to be a ring amongst them as there are a meat ring, a fruit ring, a fish ring, etc. The people who have all the trouble with the fowls do not get value for what they sell. Why? Because the shopkeepers have all the profit. For the last eight years to my knowledge poultry has been 3s., 3s. 6d., 4s., 4s. 6d., 5s., and 5s. 6d. each, not a pair. If there is no profit in that figure it is a very strange thing to me. If the man who sold the fowls had some of that profit it would pay him, I am sure. It is no use to say Perth shopkeepers have no profit out of the figures shown here."

Bush Roads.—One of the best ways to keep a bush road in first-class order is to use a drag, made from a split log. A road dragged twice a year, spring and autumn, will rarely require anything more doing to it. The drag is so worked that a good crown can always be left on the road. A stiff clay road becomes "puddled" by traffic and the lumps are prodigiously hard and uncomfortable to ride over, as most people know. But being hard they may be made a very good foundation for a road if properly handled. Of course all such roads should be underdrained, and in the course of a few generations will be. The people living in the world at any one time cannot do to it all that requires doing. As people multiply the earth's surface requires more and more fixing up to suit their convenience. But meanwhile we want the best roads we can get with the means available, and in default of more thorough treatment the "split log drag" persistently used, will doubtless prove very serviceable. We do not know who started the split log drag craze, but it is having a most remarkable run, a picture of it having appeared in the majority of papers published which purport to instruct rural people. Of course the presumption is that any suggestion so greedily taken up by the Press of the country is utterly without merit, but in this case that conclusion would be an error. A drag made of two split logs and hung so as to throw dirt to the centre is really a very good road builder, if heavy enough, if properly used, persistently and at the right times. The split log drag, however, is not, as one might be led to suppose, the final solution of all road building difficulties.



Plantation of old and young India Rubber Trees (*Ficus Elastica*), the young trees started by marcottage.

An Ancient Milking Strain of Cattle.—It may not be generally known, says a contemporary, that there still exists, in the possession of Lord Iveagh, at Elveden, England, a very ancient local breed of dairy cattle, known long before the Red Polls were ever heard of. It is the last of the old breeds that has been kept quite pure. The herd has changed hands some two or three times. It was hoped that their present owner would give them a permanent home, but it is feared that before long they may be in the market and dispersed, unless someone can be found to save the breed from extermination. There are now, I have been told, 25 cattle of all ages, and of both sexes. Arthur Young speaks of them, and calls them, "Dun-polls." In his time they were phenomenal milkers, so much so that were not the quantity of milk given vouched for by a reliable authority, one would hardly credit it. It is supposed that the herd was at Riddlesworth in very ancient days, when the place was owned by a family who bore that name, and whose coat of arms was "Vert a bull passant or." As these animals, though called "Dun," are of a beautiful golden colour, this shield may possibly, with its golden bull on a green ground, have been adopted by the family for the special reason that the breed originated there.

Cold Storage.—The Government refrigerating works, which are under the administration of the Agricultural Department, are of such great importance to the agricultural community that it is surprising more use is not made of them. This was strikingly illustrated at the late Royal Agricultural Show. An exhibit of apples had a very withered and desiccated appearance, their value as saleable fruit being greatly depreciated, owing entirely to the want of proper care in keeping. Another exhibit of apples that had been kept in cool storage for some months looked very superior, and gave the impression that they had only recently been picked. The cost of storage had amounted to a few pence only, whilst the difference realised at selling was many shillings. The charges at the Government refrigerating works at the present time for cold storage is one penny per week per cubic foot. The above is only one instance of many that could be given. Not only fruit, but poultry, when plentiful and consequently cheap, could be killed and kept in cold storage until prices improve. The same can be said of eggs, butter, etc., etc. The difference in the advanced prices realised and the cost of storage has always been a matter of considerable profit to those availing themselves of the opportunity of using the works. The following extract from a lecture recently given by Mr. Cairns, manager of the Government refrigerating works of this State, will be found interesting. He said:—"Growers know full well that beauty is only skin deep, but at the same time the best-looking articles always fetch the best price. To preserve the beauty of their commodities and place them on the consumer's table as fresh and fragrant as when they left the orchard, requires cold storage, buildings, and machinery of the most costly type. If we, in this State, are ever to rise to great things in fruit storage for ourselves for off-season requirements, or step into the arena of competition with the older and more experienced, although not better equipped, competitors, work should begin as soon as possible. Before reliable data can be obtained on the keeping qualities of each particular kind of fruit, careful experimental work will have to be undertaken. The time is now ripe for growers to seriously consider the advisability of carefully selecting a few cases of each kind, and sending them in to the cool storage works. The outlay will be but very slight

compared to the knowledge gained by the grower who is progressive enough to experiment on these lines."

How to use Hens Manure.—Hens require a highly nitrogenous ration, for the reason that eggs contain a very high percentage of protein, and one of the constituents of protein is nitrogen. If poultry food is rich in nitrogen, it is natural to suppose that poultry manure must be rich in that element, and so it is. In fact, it is well known to practical poultrymen that hen manure is a very high-grade fertiliser, provided it has been properly preserved. There is, however, no farm manure that decomposes more rapidly than does hen manure, and when it decomposes it loses nitrogen very rapidly. In fact, it is the rule rather than the exception, that hen manure loses fully 75 per cent. of its fertilising value before it is put on the soil. The per cent. of nitrogen in hen manure has been found to vary from 7 to 3 per cent., the phosphoric acid from 5 to 2 per cent., and the potash from 25 to 9 per cent. Where a flock of a hundred or more hens is kept on the farm a large amount of valuable manure is produced during the winter months, and it is very important to care for this manure in such a manner as to reduce the loss of fertilising constituents to a minimum. A number of substances, which, if mixed with hen manure, are capable of preserving it for a considerable period of time. Acid phosphate and kainit serve a useful purpose in this connection. The Maine station recommends the following: Mix with 30 pounds of hen manure 10 pounds of sawdust, 16 pounds of acid phosphate, and eight pounds of kainit. Mixed in this manner the manure retains its full value from six to eight months, and when compounded according to this formula contains approximately the following percentage composition: Nitrogen 1¼, phosphoric acid 4¼, and potash 2 per cent. A fertiliser of that kind, if applied at the rate of two tons per acre, would be a most excellent one for grass lands or for other agricultural crops. It would also be very valuable for use in gardening, where it is desirable to maintain the soil in a high state of fertility. Land plaster, or calcium sulphate, as it is called, is another substance which keeps hen manure from decomposing and from liberating its nitrogen. Parts of the land plaster combine chemically with the ammonia that escapes from decomposing hen manure and forms a non-volatile substance called ammonia sulphate. This, when applied to the soil, becomes available and capable of serving as plant food. The phosphoric acid and potash, of course, is not lost during the fermentation process. These substances are only lost through leaching.

Care of Farm Implements.—One of the most noticeable and worst features on the farm is the want of care of implements used. Nearly every tree in the vicinity of the cultivated paddocks is made the protector of some piece of machinery or tool. Here you will see a harrow, there a plough, a seeder, or fertiliser distributor, and often the reaper and binder is left out in the open from one year to another covered with a piece of sail-cloth or bags sewn together, which, instead of protecting the machine, actually assists in destroying it by holding the moisture, and soon becomes rotten and useless. The real damage done to tools and machinery on an ordinary farm where such carelessness is allowed is often greater than what it would cost to put up a good shed. The following remarks, made by the Secretary for Agriculture of South Australia to a meeting of farmers, are very much to the point.

He says that—"during his 30 years' experience amongst farmers he had met a great many who gave their implements little or no care while not in use, and to such his remarks were addressed. It was well known that implements constructed wholly or partly of wood needed a deal of attention and protection from the weather, and it paid well to provide proper shelter-sheds in which to store such implements when not in use. A seed drill must, during the seeding, be exposed to the weather; but, when finished with, it need not be left under a tree with two or three bags over the seed-box. As the acids in the fertilisers corrode the metal fittings, this machine requires thorough cleaning when finished with, in order to keep the gear in good working order. The harvesting machinery requires special attention. The binder should be cleaned before the oil hardens about the bearing parts; the canvas and knives should be put away; and any necessary repairs attended to before they are forgotten. With stripper and harvester similar attention was necessary. The comb should be removed, or the points protected by means of a wooden sheath. The bright parts should receive a coat of linseed oil to protect them from rust, and when put away in the shed a block should be placed under the off check to prevent the frame from twisting, as it is apt to do. Many farmers fail to realise the value of good paint on woodwork. He had seen wagons that had never received a coat of paint from the time they left the builders' hands until they went to pieces. The time and expense of painting were well spent. There were a number of things a farmer should do, and others that he should not do with his implements. Amongst the 'dont's' were the following:—Don't take a bolt from one part of an implement to re-place one that has been broken or lost from another part. Don't wear the plough-share or plate away until part of the foot is worn away also. Don't expect to do good work with a plough cutting 12in. where it should cut only 8in. Don't expect to reap all the wheat with a worn-out comb. Don't allow the farm poultry to roost on the machinery. Don't neglect the harness; soft leather is not only more comfortable to the horse, but will last longer than hard leather. A rub with neatsfoot oil now and then will assist to preserve the leather and keep it pliable. Finally, don't expect that all these matters will be attended to by the farm hands if the farmer himself is indifferent. Members generally agreed that greater attention should be paid to farm implements."

Subscriptions to the "Journal."—In this issue of the *Journal* will be found a form to be filled in by those entitled to receive the *Journal* free. Others than those who are getting their living from the land can have the *Journal* sent them post free for one year on forwarding the sum of five shillings to the Department.

THE SOUTHERN DISTRICTS.

The Director of Agriculture had recently a week's tour in the Southern Districts. Mr. Chaplin furnishes the following account of his observations during the journey along the Great Southern Railway to Albany and of a visit to the Denmark country, lying about 45 miles to the west of Albany:—

"As York is neared, the first evidences of the wheat-producing areas are seen. Round about York and Beverley and to Pingelly the crops generally may be considered as being fairly good, and the average yield of wheat may be nearly equal to that of former years. The excessive rains, however, at intervals during the winter months have affected the crops in a very marked degree, especially in the low-lying portions of the fields. Some time ago mention was made by me of the certain disaster which must attend plants put in a soil which remained in a water-logged condition for several months. The results which have now accrued simply bear out similar experiences of such desultory methods of farming.

"At Pingelly a farmer stated that he had lost about 20 acres of wheat through a non-observance of what he can now realise were but simple rules in cultivation. On the slopes the crops are in nearly every case looking splendid, and excellent yields should be obtained. There is surely an object-lesson to the farmer here in the contrast between the robust growth on the gentle declivities and the sickly, almost defunct, growth in the undrained valleys. It is obvious that the yields can be considerably increased in many situations by a judicious cultivation of the land in conformity with the grades necessary to bring about surface drainage. A computation of the loss attending the planting of soil in a water logged condition, taking into consideration the waste of fertilisers, cost of ploughing, etc., would, no doubt, show that under such circumstances a farmer would gain considerably by cultivating properly one-half the area.

"To secure better returns on the low-lying portions of such land as alternates on nearly every holding in these districts, recourse must be had to narrower lands and the more frequent use of the single-furrow plough in ridging and finishing. On the slopes wider lands, of course, are permissible. An objection against this method is, of course, raised when the question of harvesting machinery bumping over the furrows is discussed; but the fact cannot be overlooked that there will not be anything to harvest on these lands if such a system of cultivation as suggested is not resorted to. When a farmer finds that his methods are continually leading to failure, it is time to change them.

"It is evident that the progress of agriculture in the future must be along lines of intellectual achievement, and the farmer, to be successful, must use his brains as well as his hands. We have crossed the Rubicon which separates the kingdoms of brawn and brain; henceforth and for evermore agriculture will be ruled and directed from the kingdom of brain. The gospel of agriculture must be preached, and then, under the new dispensation, there shall be an awakening in the new agriculture in all our rural districts. The time is approaching when mixed farming must be adopted in all the

agricultural districts of the State. The necessities of the time will demand it. Then the whole of the methods now being pursued in these localities must, under the exigencies of a new position, be recast.

"At Westbrook, 124 miles from Perth, about 25 residents were met, and the question of permitting 50 acres of the reserve there for an experimental farm to be set aside as a township site was discussed. At present there is only a siding at Westbrook, one store, and a State school. There is not any accommodation whatever for travellers nearer than Pingelly (six miles) or Brookton, which is a similar distance. The reserve is very good land, and the Department may take steps to have some agricultural experiments made here. For many miles round about Westbrook there are farmers gradually bringing about a transition from the primeval forest to the cultivated farm. Here, as in most other places traversed by the railway, the view from the railway carriage as regards the scope under settlement is deceptive. A mile or two from the line, and we emerge on to cultivated farms, with green wheat crops standing out significantly in the midst of portions of the yet unsubdued forest. In the neighbourhood of Pingelly this is specially noticeable. The crops sown early look well, and promise a good yield, but here, as elsewhere, the failures in low portions of the field will help to diminish the general average.

"Continuing the journey to Albany, it was noticeable that the crops, as a rule, were promising well. Some really good were seen on the higher lands, but the presence of water in the soil in many localities was again indicated by the struggle the plants are making for existence.

"From Albany, in company with Mr. N. W. McKail, a visit was paid to the settlement known as the King River. Some of the old residents talk of the first settlement taking place round Albany about 60 or 70 years ago. Such being the case, the lack of development is extraordinary. The gradual decline in business in the town—according to the testimony of the residents—is an evidence that the trade hitherto has been dependent on what may be termed an ephemeral quantity. To bring about that permanency of prosperity which is always associated with a comprehensive utilisation of the soil, the lands in the districts must be given over to the right class of agriculturist. The situation and climate should make this an ideal dairying centre. A great amount of the land has been alienated, but, with the exception of a few instances, it is not being put to any practical use.

"In the King River district there are a few orchards, notably one owned by Mr. Neuman, which are doing well, while a few market-gardeners eke out a living by sending vegetables to Kalgoorlie, the cost of freight being £3 3s. per ton. The country in the vicinity of Albany is timbered with redgum, jarrah, banksia, etc. On the low hills the karri timber indicates the presence of that chocolate soil which is capable of being readily put into a high state of fertility and tilth. There is not any dairying worth speaking of being carried on, and nearly all the butter consumed in the town is imported. It must not be forgotten, however, that no attempt has been made to give an incentive to this or any other branch of the agricultural industry in the neighbourhood. A peculiar apathy has apparently prevailed in the fostering of rural pursuits, but there are signs that a new era in the primary industries is about to dawn.

"A visit was paid to the Denmark country, in company with a number of settlers. A railway owned by a private company runs to a centre of good land here, but, as a special report concerning this land and railway is being

prepared for the Government, nothing further can be said regarding it at present. To the west of Albany, continuing for many miles, there is some of the best land for dairying or all-round agriculture in the State. The sloping hills of rich soil, the fertile valleys, and incomparable climate are the main factors in establishing its worth. English grasses grow luxuriantly, as do all the English fruits. It is well watered by many streams, and it can be described as a land

"'Made green by the running rivers,
And gracious with temperate air.'"

THE LIMING OF SOILS.

By E. A. Mann, Government Agricultural Chemist.

The application of lime to the soil is probably one of the oldest methods of treatment employed in agriculture. It was apparently employed by the Romans 2,000 years ago. In various European countries it has been for many years past, and is still practised extensively. In fact in all countries where the principles of agriculture are scientifically practised it is recognised that the use of lime in various forms may be of immense benefit to the soil.

Apparently this has not been sufficiently recognised in this State, and I venture to think that a more favourable field for its employment would perhaps be hard to find.

In the course of the analysis of samples of soils from various parts of the State I have often been struck by the small proportion of lime which they contain. Until a comprehensive soil survey is made it would be absurd to generalise as to the whole of our land, but at least I can say that there are many localities in which the soils are undoubtedly deficient in lime, and I therefore present the following notes, gathered from various sources, in the hope that they may lead to inquiry and experiment on the part of agriculturists.

The description of the action of lime may be given under various heads, viz.: 1, Direct manurial action; 2, chemical action on soils; 3, physical effects; 4, effect on soil bacteria.

Direct Manurial Action.

It is of course recognised that lime is necessary to plant life. It is present in the ashes of plants, and appears to be an essential constituent of their substance. What part it plays is not exactly known, but it is believed* that it assists in the conversion of starches into cellulose in the plant structure.

* Johnson. How Crops Grow—p. 214.

Authorities differ as to the actual amount of lime which should be present in a soil, but it is believed by many that if only ·5 per cent. is found the soil is in need of immediate liming. This perhaps may be excessive, and in this State we take a standard of ·3 per cent., but it is pretty certain that the last is the irreducible maximum, some writers advocating a standard of at least 1·0 per cent.

A practical method of testing whether a soil is deficient in lime is thus described in the United States Department of Agriculture, *Farmers' Bulletin No. 77*, to which I am much indebted for information contained in this article. This depends on the ready response made by beets of all kinds to liming. "Lay out two plats of land, each about 12 feet by 30 feet, manure each of the plats with like amounts of a fertiliser containing potash, phosphoric acid, and nitrogen, and apply lime to one of the plats at the rate of from two and a-half tons per acre (40lbs. per plat would be approximately two and a-half tons per acre.) A comparison of the growth and yields on the two plats will furnish a safe means of judging whether the soil will respond profitably to applications of lime."

Lime is particularly likely to be wanting in soils derived from granite and also in those derived from mica schist and sandstone, and analysis has already disclosed that there are many such soils in this State. Even soils of limestone origin may be benefited by the application of lime. They may be so charged with inert organic matter or so acid that the profitable production of crops is impossible. This, however, is probably a rare case in this State.

Chemical Action on Soils.

1. Lime is said to take the place of potash in certain chemical compounds which exist in soils and which are of such a character that plants cannot make use of the potash they contain. Thus lime may be of great service in liberating the potash and placing it at the disposal of plants.

2. When soluble phosphates (superphospates) are applied to lands deficient in lime and magnesia* the phosphoric acid combines with the iron and alumina of the soil to form compounds which are not readily utilised by plants. If, however, the soil is well limed, this change is retarded, so that the plant can make use of much of the phosphoric acid before it assumes a less assimilable form. If, on the other hand, inert forms of phosphates are already in the soil, the application of lime is believed to convert them into available forms.

3. The value of lime on "alkali" soils has been conclusively and abundantly illustrated in America. The black alkali (sodium carbonate) is converted by the application of gypsum (sulphate of lime) into sodium sulphate with the simultaneous formation of carbonate of lime, whereby the alkalinity is so far reduced as to render possible the profitable production of crops.

4. The production of acid or sour humus is a common occurrence in soils where there has been much decay of organic matter and a deficiency of carbonate of lime. This is very common in our black swamp soils, so much utilised for market gardening, etc., and often occurs in upland soils of a sandy nature and well drained. Indeed, I have been much struck by the large number of soils of a sandy description, examined in my laboratory, which

* Neutral phosphates and chili saltpetre should be substituted for superphosphate and sulphate of ammonia on sandy soils deficient in carbonate of lime.

have a marked acidity. This acidity is very noxious to most agricultural plants, and an effective and economical remedy is the application of lime, which will neutralise the acidity. This also promotes the production of carbonic acid, which in turn acts upon the plant foods of the soil, rendering them more quickly available to plants.

Physical Effects of Liming.

The addition of lime to clay soils has the following beneficial effects:—

(*a*.) Soils which in wet weather become water-logged through lack of porosity and then become insufficiently aerated for the proper development of the root systems of plants, are opened up and rendered more porous.

(*b*.) The caking to which such soils are liable in drought is also prevented.

(*c*.) The surface of the soils is rendered more friable and lends itself better to tillage.

(*d*.) Through the improvement of drainage thus induced surface washing is prevented.

It is of value in the opposite direction with soils composed of silicious sand, as it is said to render these more compact. In this case, however, it is best to add a clay marl to the soil, containing a fair amount of carbonate of lime. The clay as well as the lime then tends to improve the physical quality of the soil.

Effect on Soil Bacteria.

There are two great processes going on continually in the soil, which are now known to be due to the activities of bacteria, viz.:—

(*a*.) The conversion of ammonia and other compounds containing nitrogen, derived from decaying organic matter and nitrogenous fertilisers, into nitrates, the only form in which (it is believed) plants can utilise the nitrogen.

(*b*.) The utilisation of free nitrogen of the atmosphere by leguminous plants.

Both these processes (especially in sour soils) would appear to be greatly facilitated by the application of lime.

Liming sometimes Injurious.

The dangers to be avoided in using lime are thus described in the bulletin already quoted:—

"Excessive amounts of lime, especially on light soils, may have an injurious action. This is particularly true of freshly slaked lime upon light sandy soils containing but small amounts of organic matter. It hastens unduly the decomposition of the organic matter, and thus renders the soil more open and less retentive of fertilisers and moisture than before. If freshly slaked lime must be used upon such soils it should be applied in small amounts and at not too frequent intervals. As stated heretofore, clay marls are much better adapted than other forms of lime for the improvement of such soils. In lieu of such marl, wood ashes or lime which

has been exposed to the action of the air for a long time, might be preferable to lime freshly prepared.

"Before the advent of complete fertilisers it was a common adage that 'liming makes rich fathers and poor sons.' If lime is used alone it serves to liberate potash, nitrogen, and perhaps sometimes phosphoric acid, and the extra drain of increased crops on the soil naturally leaves it finally in a worse condition than at the outset. In other cases the soil reverts after many years to its former state of unproductiveness without appreciable injury. Continued success can only be obtained by the use of the other essential manurial fertilising constituents in connection with the lime. Few, if any, cases are on record where the soils originally in need of lime have failed to continue to give good results from liming when care was taken to maintain a supply of the other essential constituents and where lime was applied in moderate amounts.

"Dolomitic (magnesian) limestone contains widely varying percentages and lime. Such stone, if containing high percentages of magnesia, may sometimes prove objectionable if used exclusively. When such material is applied to soils the lime is removed by crops and the drainage water more rapidly than the magnesia, and if the lime thus becomes practically exhausted the residual magnesia in the soil may have an injurious action. This can, however, be overcome by adding more lime. Rather than use such lime for long periods of years on the same land, it would be preferable to alternate frequently with lime containing little or no magnesia.

"Some magnesia in lime is by no means objectionable, and may, on certain soils, prove positively beneficial."

Plants Benefited or otherwise.

The following three lists of plants are given with which tests were made at the Rhode Island Experiment Station. Many of the plants are unknown to us here, but are all quoted to show the relative proportions of those benefited or injured:—

Group 1. Plants benefited by liming.			Group 2. Plants injured by liming.	Group 3. Plants nearly indifferent.
Spinach	Sorghum	Dandelion	Serradella	Indian corn
Lettuce	Clover	Swedish turnip	Water melon	Common miller
Beets	Wheat	Pepper	Blue lupine	Hungarian miller
Gumbo	Timothy grass	Pea	Sorrel	Golden miller
Salsify	Oats	Peanut		Rye
Celery	Egg plant	Martynia		Potatoes
Onion	Cautaluope	Tobacco		Carrots
Parsnip	Asparagus	Alfalfa (lucerne)		Rhode Island bent grass
Cauliflower	Kahl-rabi	Barley		
Cucumber	Cabbage	Kentucky blue grass		Red top grass

In the first group not only was the crop greater, but in many instances was earlier when the soil was limed. Even the plants in the third group were benefited by lime on very acid or sour soil.

Potato scab, "Club Root" in turnips, cabbage, etc., and other plant diseases are said to be greatly lessened by the use of lime.

Forms of Lime used.

There are many forms of lime which can be and are used for agricultural purposes, but I will here only describe those which are practically available in this State.

Carbonate of Lime.—(Limestone, chalk—contained also in varying proportions in Marls.)

Caustic Lime ("quick" or "burnt" lime).—This is the most economical form in which lime can be bought when long transport is necessary—it contains up to about 95 per cent. of actual lime. Sometimes it contains considerable magnesia, as mentioned above. A ton of limestone converted into quicklime yields 1,100 to 1,200lbs. Hence it is economy to burn where the stones are quarried.

When slaked it takes up considerable water, and a ton of lime becomes about one and one-third tons of slaked. Hence it is economy to slake on the ground where it is to be used.

Gypsum (Land plaster, selenite).—Is sulphate of lime combined with water—when heated it loses its water and forms plaster of Paris. This seems to occur in considerable quantity in large natural deposits in this State.

Which of these forms of lime is best to use, depends chiefly on the price at which they can be supplied. Where a soil is seriously deficient in lime gypsum may act as a direct manure, its chief benefit, however, is generally attributed to its action on potash salts, as already described. In modifying the physical characters of clayey soils, slaked lime or the carbonate is said to be more efficacious than gypsum, but the latter is claimed to be best for liberating potash—the former are best for correcting acidity. In the treatment of alkali lands, however, gypsum cannot be replaced by any of the other forms of lime.

Owing to the fact that gypsum contains only about one-third as much lime as quick lime, it is at a disadvantage for most purposes for which lime is applied to land, unless, of course, exceptional circumstances render it possible to sell it at a correspondingly low price.

Phosphate of Lime occurs as bone, guano, and phosphatic rocks. Unfortunately no deposits of these phosphatic rocks have as yet been discovered in this State, but in other countries (notably America) they have been used very effectively on acid soils, by direct application, after being finely ground.

Superphosphates, which are prepared by treating phosphatic rock with sulphuric acid, generally have about one-third of their lime combined with phosphoric acid, and two-thirds with sulphuric acid. That which is combined with sulphuric is simply gypsum. For this reason (*see* above) superphosphates frequently do not work as well on acid soils as ordinary undissolved phosphates or bone, and they may even exert an injurious action on such soils if they are naturally deficient in lime.

Basic Slag (Thomas's Phosphates) also contains a considerable amount of lime in its composition, more, indeed, than the ordinary high grade phosphates, and does not have the injurious effects of superphosphates. It is, therefore, of special value for acid soils, especially those rich in organic matter, like swamp soils.

Wood Ashes contain a large amount of lime in the form of carbonate, varying, of course, with the wood from which they are derived. It is probable that the ashes obtained from the waste of our large timber mills might be turned to profitable account on our soils, but this will, of course, be governed by their lime content and cost of transport. In reckoning their value, however, consideration must be given to the valuable carbonate of potash which they also contain.

How often should Liming be practised.

The following answer to this question is quoted at length from the Bulletin already referred to :—

"The frequency with which liming should be practised depends upon several conditions. For example, upon the character of the soil, the quantity of lime employed in each application, the number of years involved in a rotation, the plants to be grown, and their order of succession. Formerly, in England, large quantities of lime were applied at somewhat rare intervals, but there and elsewhere at the present time the preferable practice seems to be to use small amounts and apply it more frequently. As a general rule, it may be stated that from half a-ton to one and a-half tons of lime per acre applied every five or six years is sufficient. There may exist extreme soils requiring either more or less than these amounts. If soils which are quite acid and have not previously been limed are to be seeded, with the intention of allowing them to remain in grass for several years, as much as two or three tons of lime per acre may be advisable. Only very extreme cases would call for larger applications. If in a rotation covering a considerable number of years two crops especially benefited by lime are introduced at about equidistant intervals of time, it may be advisable to lime twice in the course of the rotation, each time just prior to their introduction. In renovating acid pastures and meadows it is usually preferable to apply a fair amount of lime upon the furrows when they are first ploughed, so that they may be thoroughly mixed with the soil by subsequent ploughing and harrowing, and just prior to seeding to grass make another generous application. By such treatment, provided the other essential fertilising ingredients are employed, a good stand of clover, Kentucky blue grass, Timothy and other grasses may be obtained where in many instances they were formerly partial or total failures, and where only redtop, Rhode Island bent, and grasses having similar soil adaptability, could be grown. Where land is kept in grass for a number of consecutive years, top-dressing with lime may be advisable, particularly if ordinary commercial fertilisers are employed in lieu of stable manure.

"Lime in the form of carbonate of lime, as in marl, wood ashes, etc., can usually be applied with safety in the spring or at any other season of the year; but autumn is always the safest time to apply caustic or slaked lime. The latter form changes gradually into carbonate of lime, which is not caustic, upon exposure to the air, but usually a considerable quantity has not yet reached that stage when applied, and it may in consequence act too energetically. This is particularly true if the soil is light and sandy and if plants, which are but little helped by lime, are employed. On very acid soils, particularly such as contain much humus, there is little or no danger from applying reasonable quantities of lime in the spring. If caustic or slacked lime is applied in excessive amount it may not only injure plants directly but also indirectly by rendering the texture of the soil unfavourable; it may also make the soil temporarily so alkaline as to interfere with the activity of

the organisms which transform ammonia into readily assimilable nitrates. Injury thus arising can not ordinarily be of long duration, for the reason that the carbonic acid of the soil changes the caustic lime rapidly into carbonate of lime, and thus the alkalinity of the soil is soon reduced."

How to apply Lime.

Though some advocate spreading the lime on the ground before ploughing, this has two disadvantages :—

(1.) The lime gets at the bottom of the furrows, and as its tendency is to work down, it may be quickly carried away from the surface soil and beyond the reach of plants.

(2.) It is not readily distributed throughout the soil, and so does not come into sufficiently intimate contact with the organic matter of the soil to effect its decomposition.

The best plan seems to be to spread the lime on the ploughed land and then harrow in. A most important point to be observed in applying lime in all its forms is to mix it with the soil as thoroughly as possible, the finer the particles the better being the result.

For slaking caustic lime on the ground, about three buckets of water should be sprinkled over each cask of lime and then heaped over with soil. In a few days practically the whole of the lime will be in a fine condition suitable for spreading. One plan often employed is to placed the burnt lime in piles of 30 or 40lbs., each at suitable intervals (heaps of this size 20ft. apart in each direction equals about two tons per acre), and cover the piles with moist earth. Where slaked lime is used it should be harrowed in immediately after spreading. If exposed to the air too long before harrowing it is liable to cake and form a sort of mortar so that it becomes impossible to mix it with the soil.

RUBBER CULTIVATION.

By G. Chitty Baker.

There is no tropical product that is creating such a demand at present as that of rubber. While the increase in production is calculated by the hundredweight, the demand is increasing by tons per annum. The American *Rubber Journal* of 1st January, 1905, says, in a leading article on "The Natural Supply of Rubber":—"The fact that rubber has so long been obtainable is due to the enormous original supply. But this supply has not been increased, or even kept up to the original limits, by any process of nature, and the rubber situation to-day is comparable to a private fortune of fixed limits, which is diminished in proportion as its owner draws upon it. He may spend twice as much this year as last, but this does not make him twice as rich; it only hastens the time when he will become bankrupt. It is quite possible that, somewhere or other, more rubber may be produced next year than this. It is out of the question to say in what year the

Method of Tapping a Para Rubber Tree. Third day after Tapping.

highest output of rubber will be reached. Possibly higher prices for rubber than have been known hitherto are yet to be experienced. But there is no room for uncertainty on two points: (1) a continued increase in the industrial demands for rubber; and (2) the hastening of the extinction of the natural supply by every addition to the yearly production."

It is very problematical as to when the production will meet the demand, so far as can be seen at present, this will not take place for very many years to come and certainly not during the lifetime of anyone living at present.

One great reason against the possibility of over-production is the very limited area in which the rubber tree can be profitably grown. Twelve degrees north and south of the equator seems to be the boundary line of successful cultivation, although trees have grown remarkably well at Cairns, in Queensland, which is situated about 17 degrees south. This being so, there is no reason to doubt of its being equally successful in Kimberley say from Derby northwards.

At the present time the greatest strides are being made in Central Africa, where 60,000,000 plants have already been set out and about 2,000,000 more are being planted every year.

So far as this State is concerned it has yet to be decided which is the best kind of tree to plant, or, in other words, which kind of tree is likely to grow the best and give the greatest yield of rubber.

At the present time the Para rubber tree (*Hevea Braziliensis*) not only yields the most latex, but is far and away the best rubber obtained. The tree is a native of Brazil, it grows in great profusion along the banks of the Amazon river, and the name "Para" is derived from the name of the port at the mouth of the river from which it is shipped.

There are 40 or 50 known varieties of rubber-giving plants; but only five or six of these are exploited commercially, the chief being *Hevea Braziliensis* (the true Para rubber tree), *Castilloa Elastica* (the Central American, or Mexican tree), *Ficus Elastica* or Ramboug (an Indian tree; this is the plant often grown for ornamental purposes in rooms), *Landolphia* (a vine, or creeping plant, found in Tropical Africa). *Panamina Philippinensis Radek*, *Willughbria firma Blume*, and *L. Kirkii*. These last four are all strong, robust growing vines, and might be profitably cultivated in any bush lands without the trouble and expense of clearing. The illustrations of rubber vines reproduced, as well as illustrations of the Para and other rubber trees are taken from a book on the "Gutta Percha and Rubber of the Philippine Islands," written by Penoyer L. Shuman, Jun., Ph. and D., and published by the Department of Interior, Manilla.

How to Start a Plantation.

A warm moist flat should be selected, with a fair depth of good soil, well drained, and in a locality where the temperature rarely falls below 60 degrees. The ground should be well cleared and worked. The seeds are sown an inch deep and about eight inches apart, in a well-prepared nursery bed, and lightly covered with a little vegetable mould. They are kept lightly shaded, and watered when the surface of the ground is dry. They germinate in about three weeks. In 10 or 12 months the young plants are two feet high and ready for planting out. They should be set in the ground about 15 feet apart on the quincunx system, which will allow for about 220 trees to

the acre. The planting should be done in the rainy season so that the plants may not receive any check. After being once established, very little attention is required beyond cultivating once or twice a year, keeping the plants free from weeds for at least two or three feet from the stem.

Some trees may be tapped at six years old, while others take eight to 10 years before they are fit; no tree, however, should be tapped until they are at least two feet in girth at a spot about three feet from the ground. In tapping trees care should be taken that they are not exhausted, half to three quarters of a pound of latex is a fair yield per tree at six years old. With care during the first few years of tapping, trees will continue to increase in their output until they reach maturity, which ranges from 25 to 50 years old, trees 100 years old are known to give yields of 15 to 20 pounds of latex and in many cases even more than this per tree.

Treatment of the Latex.

There are many ways of treating the latex or milk. The Indians collecting the milk on the Amazon make a fire of nuts from the Uricary Palm. The burning of these nuts produce a dense, black smoke, the acidulous properties of which has proved to be the most efficacious for rapidly coagulating the sap of the rubber tree. Near each fire a large earthenware pot, filled with the milk from the tree, is placed between a couple of Indian boys, each boy having a small, round bladed paddle in his hand; the blade of the paddle is dipped into the milk, which, adhering to the wood, is held in the smoke of the fire, which rapidly coagulates and turns into the black Indian rubber of commerce. The round blade of the paddle, now covered with a coating of rubber, is again dipped into the pot of milk and smoked, the process repeated and continued until the rubber is about two inches thick, a cut is made with a sharp knife along the outer edge of the paddle, when a round cake of rubber is easily removed and placed in a heap alongside the operator. So the process is continued until the whole of the sap collected has been treated.

This process was adopted some 30 years ago, and is still in use. In Ceylon, the milk is placed in a glass churn or other receptacle (machines for the purpose are occasionally used) in which it can be shaken. On standing, the caoutchouc floats to the top as a cream. The beery fluid below is run off by the tap. The cream is mixed with water, churned, left to stand, and the process repeated. The rubber is thus obtained almost pure in three creamings, and the cream is poured out to dry on a porous surface, when a thin sheet of perfectly dry and almost pure caoutchouc is obtained in a short time. Good results are obtained with less trouble by the use of the centrifugal machine, first applied to rubber separation by Biffen. The term given to this kind of rubber is "biscuit," and a parcel of 1,200 pounds of "biscuit" from Ceylon was sold last July at 6s. 8d. to 6s. 8½d. per pound.

Washing Machines.

There are many other machines being introduced, but so far we have not had sufficient experience with them to say which is best. A machine for washing rubber known as the Michie-Golledge process has many users and admirers. A Ceylon paper thus speaks of it:—

"The report of a leading firm, whose name is very familiar and stands high in the estimation of Ceylon, reports on a sample of 'worms' as follows:— 'Very pale yellowish in colour, in worm form. It is very pure, and of

A Rubber Vine (*Parameria Philippinensis Radlk.*) growing in the Forest.

excellent quality, which attributes alone would insure for it a ready market if handled in useful-sized parcels. It is exceptionally free from moisture.

"'Being a grade of rubber prepared by a new process, it would not yet be known as to how it would turn out in the various processes of manufacture, and for this reason it is difficult to estimate its exact value as an article of commerce. We have shown the sample to some of our friends who handle the product in large quantities, and they fully confirm our opinion that the same rubber in biscuits would at the moment realise more money, and command a freer market than in its present form, but we think that when its good qualities have been proved by use, and it has thereby established a reputation (as biscuits had to do), it might fetch prices on a level with the latter, or even higher, on account of its great dryness and purity.'

"The report of a local gentleman, acknowledged by all as an authority on the subject of rubber, describes the rubber prepared by this process as of 'first-rate quality,' and characterises the process as 'simple and cheap.' He also declares the Michie-Golledge machine rubber to be cleaner and more even than the best sample of biscuit rubber he has ever seen.

"This is certainly high testimony to the excellence of the Michie-Golledge process, which is bound very soon to be universally adopted. With the development of the industry and the expansion of the output of rubber, the preparation of biscuits will become prohibitive on account of the labour it involves, the space it takes up, and the utensils it requires."

The extraction of the milk from the rubber vines is somewhat different to that of tapping trees. The vines are cut down to within a few feet of the ground, then cut into short lengths, which are afterwards passed through a pair of rollers which squeeze out the latex into troughs. This is afterwards treated in a similar way to the milk obtained from the trees. The vines, after being cut down, invariably send out fresh shoots, and go on growing as vigorously as ever. The great advantage in rubber vine growing is, as mentioned before, that it can be cultivated in ordinary bush lands without the necessary and often expensive preparation of clearing the ground before planting. All that is required is that holes should be dug near the trunk of a low tree, so that the vine, which is very hardy, can climb up and over it during growth. It has often happened in favourable seasons that the whole bush becomes one mass of vines, the tendrils, by the aid of the wind, reaching from one tree to another. Although little or no care is required once the plants are in the ground, yet the cost of cutting down the vines and collecting the milk is very much greater than it is to obtain a similar quantity from trees.

The *Castilloa Elastica* promises to be the best rubber tree for cultivation in sub-tropical countries. The tree does not grow to such a size as the "Para"; neither does it yield the same quantity of latex, yet the quality of rubber obtained is quite as good; in fact, the bulk of the Ceylon rubber is obtained from the *Castilloa Elastica*, and realises top prices. Whether this is entirely due to the quality of the rubber or the manner in which it is marketed has not been determined.

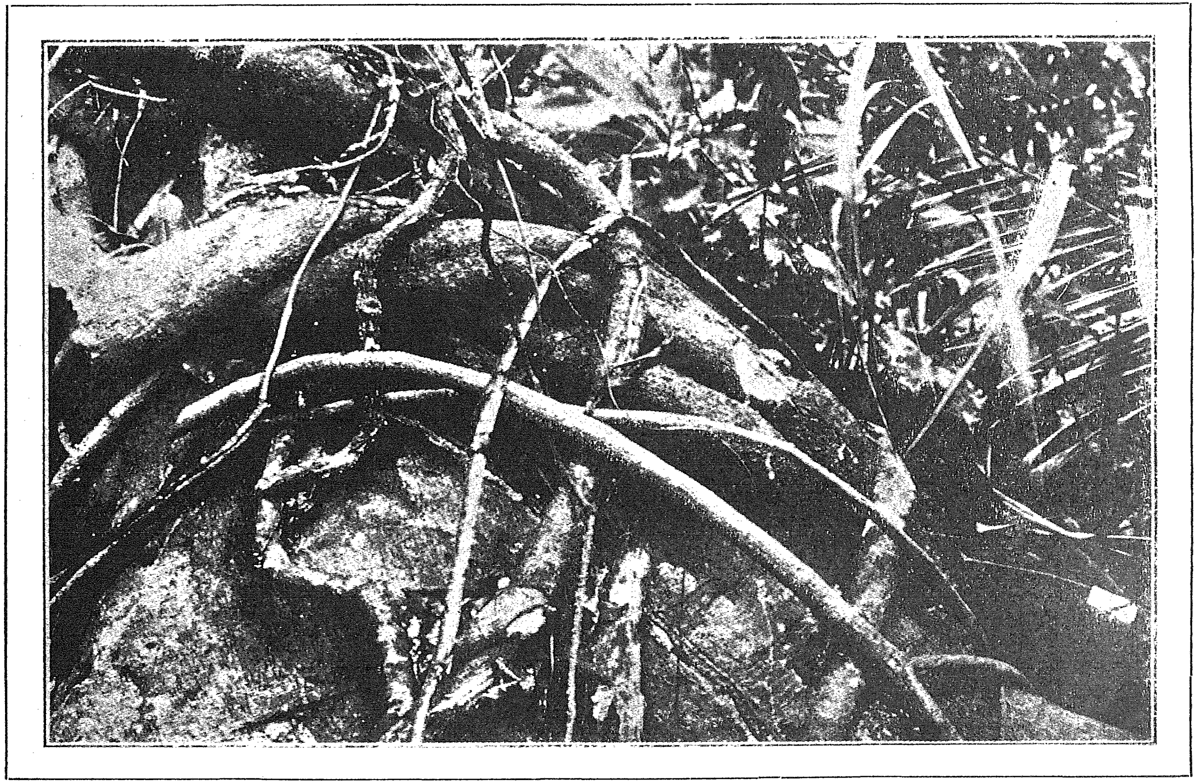
"The question (says the *Tropical Agriculturist*) as to whether the two best rubber-producing trees, Para and Castilloa, will yield latex at high elevations continues to agitate planters, and there still exists a considerable difference of opinion on the point. The case of the Manager of Somerset Estate, Gampola, in Ceylon, who wrote that he had 12-year-old Para trees

growing well and yielding him a good profit at an elevation of 2,700 feet above sea level has before been referred to in our columns; and this the *Ceylon Observer* says, appears to be nearly the limit at which Para rubber can be profitably produced in Ceylon. Another Ceylon planter, Mr. Graham Clarke, of Dimbula, writes in the same paper that he has a fine Para tree, 53 inches in girth at 3 feet from the ground, at 3,200 feet elevation, growing near a river; but even in this seemingly favourable position the tree yields very little latex and bears no seed, though it blossomed freely last year; and it is a well-known fact that the higher Para is planted the slower it grows. These facts should make planters in South India pause before experimenting with rubber on a large scale on land situated upwards of 2,500 feet above sea level.

"Similarly with *Castilloa,* which has been found to yield latex abundantly at Matale, in Ceylon, up to 1,500 feet above the sea, and, in some cases in the Burliar Experimental Garden on the Nilgiris, at about 2,400 feet, but the general opinion among experienced planters in Ceylon is that it will not yield well there at an altitude of over 1,500 feet. Mr. Proudlock, Curator of the Government Gardens on the Nilgiris, found that *Castilloa* trees three and four years old in the Burliar Garden yielded a somewhat gummy substance destitute of the properties of true rubber; while 15 months later these same trees yielded rubber intermediate in character and quality. This, in Mr. Proudlock's opinion, clearly showed that the period of change, or transition, in the quality of rubber yielded by *Castilloa* trees, namely from a gummy substance to true rubber, coincides with, or closely follows, the period when the species first begins to produce ripe seeds. From further tappings of these trees, made towards the middle of this year, a latex was obtained which possessed a fair amount of rubber with little gumminess; and next year it is anticipated that they will yield rubber of good quality. This species has been recommended from time to time by Mr. Mameron, Superintendent of the Mysore Government Gardens, as suitable for planting in the Mulnad throughout the Mysore Province; so Mr. Proudlock's future experiments will be watched by planters with interest.

"The chief point about the rubber produced in Ceylon and in the Straits is its extreme purity, the loss in manufacture from it being only from 3 to 5 per cent., while that from South American rubber is often 16 per cent. This being so, there should not be much real reason for the anxiety felt by some people owing to the fact that 30,000 to 40,000 acres of cultivated rubber are about to come into bearing in the near future in the Straits and in Ceylon.

"As showing the wide-spread interest taken in rubber production, it may be mentioned that several inquiries have recently reached us in regard to the desert plant Guayule, now being commercially exploited on a large scale in Mexico for the rubber it yields. Guayule is a shrub that grows wild over vast tracts of northern Mexico. Its scientific name is *Parthenium Argentetum.* The gummy nature of the plant has long been known, but the extraction of rubber is a recently discovered process. The wood of the shrub is ground up by a powerful revolving pulveriser, and then, by means of pressure and heat, the gum is agglomerated and separated from the sawdust, the one to be worked up just as rubber is worked up, and the other to be used as fuel for running the engine. The whole process is purely a mechanical one, no chemical at any stage being required.



A Rubber Vine growing in the Forest. To secure a good yield of Rubber the Vine should be cut down, all the bark removed, and treated for the extraction of the Rubber.

The rubber produced from Guayule does not possess the elasticity of Para rubber, but it vulcanises more easily, and it is also claimed that it deteriorates with age much less rapidly than ordinary rubber gums. Its commercial use is largely for mats, rubber cushions, etc., where elasticity is not the first requirement. Therefore, Guayule rubber relieves the market by releasing the available supplies of the more elastic Para rubber for uses to which the latter's special qualities are essential. The new product is readily purchased by rubber manufacturers in all parts of Europe, especially in France.

"As the Guayule plant is a desert product, formerly counted of no value, and growing in great abundance, and as its manipulation for the market is so inexpensive, it is clear that a profitable new enterprise has been opened up. The shrub can be cut off close to the ground, and readily starts a new growth, the next crop being matured after a period of from five to eight years. The Guayule bearing lands of northern Mexico are now being systematically developed, and factories are being established on haciendas wherever there is an available supply of 10 tons of the shrubs per day. These operations are being carried on by a Mexican company, recently formed to take over the patents of the process and exploit the industry. Foreign capital is also going into the enterprise."

The subject is of additional interest because, as Guayule thrives on the desert lands of northern Mexico, it would almost beyond question grow in similar lands in the district of Geraldton.

While it is admitted that it takes some years before a rubber-tree plantation becomes profitable, there is no reason why the ground, when once cleared and cultivated, should remain idle. Cotton could be planted between the trees, and made to give a very good yield without in any way interfering or affecting the growth of the trees. This plan has already been tried and found to work well, as the continual working of the ground for the cotton plants improves it at the same time to the benefit of the rubber. When it is remembered that the world's production of rubber is only 68,879 tons, and that the demand is estimated to reach double this amount within the next 15 years, it is not saying too much that the outlook for the man who is progressive enough to go into this matter in a liberal way will reap a rich and an abundant harvest. There are thousands of acres in the northern part of this State where one or other of the rubber plants should be successfully grown, and only waiting for the enterprise of man to create riches greater and far more reliable than the best gold mine known.

POTASH AS A FERTILISER.

By Percy G. Wicken.

Potash occurs in Nature principally in the form of salts. It is obtainable in several forms, but is much more restricted in source of supply than either nitrogen or phosphoric acid.

As a fertiliser it is available in the following forms:—

Wood ashes,
Kainit,
Sulphate of Potash,
Muriate of Potash,
Nitrate of Potash,
Barnyard manure and sea weed, etc.

Wood ashes.—When wood is burnt the potash contained in the wood is left in the ashes and is a valuable source of potash as a fertiliser. This is the reason that newly cleared land often yields a heavy crop owing to the amount of ash left on the surface after burning off the timber. Where wood ashes are obtained in quantities they may be mixed with other fertilisers and form a valuable fertiliser. The value of wood ashes as a source of potash is, however, very low, the percentage of potash contained in one ton of pure ashes varying from 2 to 4, which makes the value from 12s. to 24s. per ton. If fresh wood ashes can be obtained and placed on the ground at anything approaching this rate they are a very valuable source of potash. If on the other hand they cost more, some other cheaper forms of potash must be looked for. Apart from their value as a fertiliser, wood ashes act on the soil in a mechanical manner in the same way as humus, by making a clay soil somewhat lighter and a sandy soil more compact.

For most of the other sources of potash we are indebted to the Strassfurt mines in Germany, where the potash salts are found in immense quantities and from there exported to all parts of the world.

Kainit is a low-grade potassic fertiliser, consisting of a mixture of sulphate of potash and lime and chloride of magnesium and sodium. It is valuable on account of the potash it contains, which is about 13 per cent. It is of greatest value on dry ground, as if applied on wet ground the salty nature of the material is likely to keep the ground in a moister condition. The greatest drawback to its use is the bulky condition in proportion to the amount of potash it contains, necessitating extra charges for freight and cartage compared with the more concentrated form in sulphate of potash. Kainit is in appearance a whitish salt; if left in the bags too long it becomes hard and requires to be crushed before mixing with other fertilisers. It is soluble in water and readily available as a plant food. The sole source of supply is the Strassfurt mines in Germany, from whence it is exported all over the world. Only limited quantities have as yet been used in this State, and the price is quoted at from £4 to £4 10s. per ton. It is particularly valuable for crops such as mangels, which require a large quantity of salt.

Sulphate of Potash, or potassium sulphate, is also found in the Strassfurt mines. It is of a brownish or reddish colour and in the form

of a fine powder. It is a high-grade fertiliser, and contains from 52 to 53 per cent. of potash. Four tons of kainit are, therefore, only equal to one ton of sulphate of potash. It is soluble in water and readily available as a food for plants, and is the best source from which to obtain potash as a fertiliser. It is best applied as a top dressing when the plants are well above the ground, or else in a liquid form dissolved in water. The demand for potash fertilisers in this State has not reached to any large proportions, consequently the price is somewhat high, but as the demand increases the price will no doubt become lower. The average price at present asked is about £15 per ton, and at this price the potash is purchased at a lower rate than if obtained in the form of kainit. Kainit is the crude salt, while sulphate of potash is the more refined article after having been treated in the works which are erected for that purpose in connection with the mines.

Chloride or Muriate of Potash is a fine, white crystalline salt, soluble in water and readily available as a plant food. It is obtained from the Strassfurt mines in Germany, and purified at the works erected for the purpose. It contains about 55 per cent. of potash. It is a combination of potash and hydrochloric acid. It is also obtained as a by-product in the manufacture of chlorate of potash, as well as in the purification of nitrate of potash or saltpetre. Owing to the large amount of chlorine which it contains, it is injurious to a number of crops, and great care requires to be exercised in its use. It is also not advisable to use it on ground inclined to be salty, as it is likely to give rise to the formation of common salt.

Nitrate of Potash is another valuable source of potash. It is also known as saltpetre. It contains both nitrogen and potash, and was mentioned in a previous article under the heading of nitrogenous fertilisers. It is a high-grade fertiliser. The fertilising ingredients are in a highly concentrated form; but, as it is used for many other purposes than that of a fertiliser, the price is often too high for it to be economically used for this purpose. If, however, it can be purchased on its unit value of 17s. per unit for the nitrogen, and 6s. per unit for the potash, it is a cheap fertiliser to purchase, as the saving in weight is a consideration where heavy freights have to be paid.

Farmyard manure contains a small percentage of potash (only about ·3 per cent.); but this, combined with the nitrogen and phosphoric acid contained in it, makes farmyard manure a complete fertiliser; and, if it can be secured at a price in accordance with its contents, it is one of the best fertilisers that can be obtained.

Seaweed contains a small percentage of potash, generally about 5 per cent.; and, if it can be cheaply obtained, is a valuable fertiliser.

Some guanos contain a small percentage of potash, but it is a very variable quantity.

Other substances which contain a small percentage of potash, and are available in different localities, are preparations made from nightsoil, the deposit from wool-scouring tanks, sheep droppings, ash from sugar cane, deposits of droppings and shells found in caves.

Most mixed fertilisers which are offered for sale contain some percentage of potash, but this is generally added in the form of sulphate of potash by the vendor, so as to give an additional value to the fertiliser. No fertiliser is complete without it contains some potash.

Potash benefits the plant in the following manner:—

(1.) The woody structure of the plant is better developed.

(2.) The fleshy part of the fruit is improved in flavour and texture.

(3.) The dissemination of starch through the structure of the plant is favoured.

CULTIVATION OF GRASSES.

By D. L. Breen.

The suitability of the sands of the Great Southern Districts for the cultivation of artificial grasses has not been tried to any great extent, and the experiments, as given below, carried out by Mr. H. Climie at "Ballochmyle," Cranbrook, should be of interest to a great many settlers in this large and rapidly developing district as to the most suitable grass for their locality.

"Ballochmyle" is situated between Tenterden and Cranbrook, on the main Perth-Albany Road, and has an average rainfall of 23 inches.

The soil is a red friable loam, averaging about two feet deep, and resting on a subsoil of good, yellow clay.

The timber consisted of ironbark, yate mostly, with a few white gums scattered round.

The method of cultivation for each plot is identical, viz., the land ploughed to a depth of six inches, then well harrowed three times, and, where necessary, rolled; the seed is then spread on the ground broadcast and lightly harrowed with lever harrows. One noticeable feature in the cultivation of these grasses is the amount of chemical manures used. As much as 6cwt. of bone super. being put on with a summer crop a few months previous to the grasses being sown.

In No. 1 Plot, which contains 1½ acres of Italian Rye Grass, sown with 40lbs. of seed to the acre, and 3½ acres of Prarie Grass, 30lbs. to the acre (amount of seed rather small), sown in latter end of April, 1904, six (6) cows and calves have been depastured for some considerable time, and the amount of feed is far in excess of unstocked ringbarked land in its native state. The condition of the stock is sufficient evidence of the nutritive value of the pasture.

No. 2 Plot, containing 14 acres, is sown with Italian Rye Grass, 32lbs. of seed to the acre, sown in April this year; 5cwt. of bone super. being used on a crop of maize the previous summer. This crop of grass being exceptionally good.

No. 3 Plot contains 3 acres of Timothy Grass, 40lbs. per acre, sown in August this year under similar conditions to No. 2. This plot is the most forward of any sown this season.

No. 4 Plot contains $2\frac{1}{2}$ acres, sown with a mixture of the following in May this year, but owner thinks time a few weeks late:—

3lbs. Canterbury Rye Grass
6lbs. Italian Rye Grass
8lbs. Prairie Grass
1lb. Red Clover
$\frac{1}{2}$lb. Rib Grass
$\frac{1}{2}$lb. Trifolium Incarnation.

Two cwt. of bone super. used previous season with a crop of Linseed.

Six (6) weeks later 11lbs. of Lucerne seed per acre sown, with 2cwt. of bone super., and harrowed and rolled.

No. 5 Plot, $3\frac{1}{2}$ acres, same mixture as No. 4, later sown with 20lbs. of Lucerne per acre at end of July. Previous year the land in Maize with 6cwt. of bone super. per acre.

No. 6 Plot, 6 acres, contains a mixture of—

5lbs. Cocksfoot
10lbs. Poverty Bay Rye Grass
3lbs. Italian Rye Grass
5lbs. Prairie Grass
1lb. Kentucky Blue Grass
1lb. Wallaby Grass (N.Z.)
2lbs. Rib Grass
2lbs. Chewings Fescue
1lb. Meadow Foxtail
$\frac{1}{2}$lb. Crested Dogstail
3lbs. Mixed Clovers.

Treatment similar to other plots.

AGRICULTURAL LECTURES.

INSECT PESTS IN WESTERN AUSTRALIAN ORCHARDS AND VINEYARDS.

CONTINUATION OF THIRD LECTURE.

By FREDK. LOWE, Assistant Government Entomologist.

Having dealt briefly in the October number of the *Journal* with the question of natural and other causes, operating detrimentally or favourably on insect life in Western Australia, and the results already obtained and expected to be derived later on from importation of beneficial insect parasites, it is my intention in this part to deal with the work of introduction of insect parasites under three heads respectively, viz., procurement, breeding, and distribution of beneficial insects. Afterwards will be given descriptions and life histories of the insect pests and the various kinds of parasites that have been and are being established in the gardens and orchards of this State.

Beneficial Insect Parasites.

PROCUREMENT.

The common object in view being to keep down by means of insect parasites injurious insects in the orchards, and thus incidentally save the cost incurred by the operations of spraying, fumigating, and similar means in vogue for the suppression of insect pests.

For this purpose the Government Entomologist, Mr. G. Compére, made two trips round the world, collecting parasites found upon insect pests in the different countries visited. On reaching his objective, the first act is to find the pest and its parasite, then to collect enough of them for shipment to either of the States. Then the special transit cases are constructed and the insects packed, sailings of steamers noted, and other arrangements completed for their safe and speedy passage, as delay may be fatal to the little travellers. Accommodation must be arranged for the insects while on board. When, from force of circumstances the insects are removed in an active state, a full supply of provender to their taste has to be laid in and kept wholesome. Fresh air must be had, and as the case may be, a moist or dry atmosphere maintained—mildew is a great danger. Temperature should be regulated as near as can be to that of the natural habitat of the particular insect. Privileges are readily obtained, and little contrivances devised for close and constant observation of the insects during the journey, in order always to know how they fare and to note their changes and habits.

The period of time the different broods of a species take to pass through the changes from egg to adult, varies considerably. An exact knowledge is of manifest importance to success in the work. It is a great help if the approximate lifetime of an insect about to be transported is known, so, if expedient, recourse may be had to the cool chamber of the steamer, thus to hold it back in its development.

BREEDING.

After a consignment of beneficial insects arrives safely at Perth, one to three months may elapse before there is a sufficient number of the parasite ready to enter our service and to warrant putting them out to general work in the orchards.

A specially constructed house, fully equipped with all requirements for breeding insects on a wholesale scale, has been built by the Department of Agriculture at the side of their premises, wherein insects may be studied and bred independently of the seasons, or may be kept securely until the proper time for their liberation. Before the breeding chamber was available for these purposes, the oppositeness of the seasons was a considerable drawback and militated against the chances of success in the work. Again, the nature of an imported insect parasite from a temperate clime, associated with deciduous trees, is to lie by for the winter over the period it is needed to be active.

Adult ladybirds and allied insects arriving in an active state are kept under observation in the breeding cages in the office for a few days until their particular taste in food is ascertained. Being recuperated, they are then liberated in suitable places.

Consignments of internal parasites are received for the most part at work on the scale insects or aphides which are *in situ* on their food plant. These are placed in glass jars, and, as they breed out, liberated in a near-by

orchard, where their food is plentiful. When they have established themselves, samples are brought into the office and numbers bred out and distributed farther afield. In the insectarium the work progresses of freeing the primary parasite from its secondary form, that would otherwise operate to keep it down, and we should not profit to nearly the full extent from its work.

DISTRIBUTION.

Distribution follows to the different fruit-growing centres, and the work demands most painstaking care and caution, or else all the previous expense and trouble will have been taken in vain. In this particular a few rough and preliminary notes are appended, detailing several of the rules which have to be modified or extended, as occasion demands or knowledge and prudence dictates, to insure success in this exacting work.

As soon as the parasites prove their ability to cope with the pest they should be distributed liberally in centres where the pest abounds, any spraying and fumigating withheld. Then, as the parasites multiply, they will range at large over the whole of the infected area.

It is safest and most satisfactory for an officer from the Department to attend the first liberation of the parasites in an orchard, and to explain to the grower their nature and how they will work. However, if the orchard is remote, the consignee is advised beforehand of the intended despatch of the parasites, and explicit directions sent as to the best place and hour to liberate them ; also how to do it. The grower is informed how the parasites operate, and instructed to desist from spraying or fumigating. At the last hour in time for the mail, the insects are transferred from the breeding jar to a small glass tube filled loosely with crumpled tissue paper or dry sphagnum moss, stopped with a wad of cotton wool, and enclosed in a bamboo tube, labelled "Fragile" and "Immediate," in order to guard against accident in the post. Close confinement in a tube is liable to cause their death; moreover, there is the risk of breakage in the post.

It is best to avoid bad weather, for the parasites may not stand the sudden transition from a stuffy breeding jar to the open. They should not be liberated on an infected tree swarming with ants, usually attendant on the scale insects and aphides. Ants have been seen to seize and carry off the parasites when turned out dull and listless from shaking about in the tube. A good plan is to take them out on cuttings which are placed upon affected trees, as the parasites issue they will proceed to attack the scale insects on the surrounding trees. Once they get a start their road is clear. Connected with this part of the work are a number of advanced points which might be considered premature to touch upon at this stage.

The Codlin Moth.

(*Carpocapsa pomonella*, Linn.)

The country orchards in Western Australia keep wholly free of codlin moth: it is the most destructive enemy attacking the fruit of the apple of the insect world.

Synchronising with the time of the stoppage and destruction of imported fruit containing codlin moth grubs by the Government of this State, and above the noise certain persons make who grow or handle the infested fruit, one hears, once a year, vague rumours relative to prevalence of the pest amidst our orchards. Except for these canards, members of the hardy

annual order—which, needless to say, are unsubstantiated, or this paragraph would not be written—the dread insect is never even heard of within the blest Western State of Australia: the only apple-raising country of size wherein the pest fails to levy any toll.

Since the inception of the Department of Agriculture in 1894, the official records show but two slight outbreaks of codlin moth, on both occasions found in the larval phase of the insect's life cycle. The first outbreak occurred in Perth, mid January 1903. It was detected by an officer of the Department in a sample of locally-grown apples sent into an auction room; thence it was traced to a villa and market gardens about the vicinity of the central railway station. The last was reported from Albany later in the same season. The fruit inspector discovered the pest within the town area and adjacent to the port whereat foreign-grown fruit is permitted to enter. It seems safe to assert that both local outbreaks are now stamped out, through the resolute action of the officials placed in charge to carry out the horoic mode of treatment specially adopted by the Agricultural Department for dealing with them.

The Department can be relied upon to maintain a close watch for appearance of the enemy in any of its forms on the inspection tables, in the fruit shed, at our chief port; also to exercise, without fear or favour, the means and power in their hands to prevent its entry. Our proved measures for eradication would operate for subsequent outbreaks due to chance escapes. Vigilance in these matters must not be allowed to relax. Were the pest at any time to slip through our guards, and gain access to the orchards adjoining the towns, no obstacle stands in the path to hinder its progress throughout the fruit areas of the State. After a few seasons it would be permanently established in the orchards, and rapidly develop into the plague it is on the Southern and Eastern shores of Australia and in Tasmania. Apple growers would be called upon to sustain a yearly loss ranging from five per cent. to the whole of their crop, which, to say the least, presents an unpromising outlook. Though it is earnestly hoped Western Australia may never realise it, the fact remains. It has occurred in less favoured countries.

The bare possibility of occurrence of an outbreak of codlin moth simultaneously in a number of orchards over a large area, rendering it impracticable to do the stamping out work, as applied to local outbreaks in city areas, it gratifies us to note, does not deter the planting of large apple and pear orchards, for 47 acres were put under these trees by one grower during the present year.

If the worst came to pass, readers of the official *Journal* are well advised the Department would not be paralysed, but alive and ready to deal with the codlin moth forthwith by the introduction of the admitted chief of its mob of insect enemies, the *ichneumon fly, Calliephialtes messer, Gravenhorst.* As many as 4,000 of these parasites were consigned early this year from Spain to California. These are reported to be doing their work well.

The codlin moth grubs affect deciduous pip fruits. They spoil apples and pears for dessert purposes, and sometimes damage quinces, by eating a passage right into the fruit, usually from calyx to core and out through the cheek. One noticeable effect of the injury on the fruit while growing on the tree is to cause it to ripen and fall prematurely; or it may be blown down by quite a light wind. Codlined fruit when stored does not keep, as decay of the pulp surrounding the damaged portions quickly sets in.

A fairly sure sign of a codlin moth grub working inside a fruit is the collection of light brown excreta and webbing lodged about the eye of the fruit. The grub has cast this out of the burrow it made to enter the fruit. Suspected samples are cut open to catch the grub in the act, before a consignment is treated or condemned. After the grub has left the fruit, its large, gaping exit hole through the side of the fruit is plainly seen, and is an eyesore to all concerned.

In Eastern Australia the apple lover is almost certain to be familiar with codlin moth larvæ; unpleasantly fat little chaps, unappetisingly dubbed grubs, which he unexpectedly finds when partaking of the fruit he loves so well.

Although the work of no insect injurious to the apple is more intimately known than codlin moth grub's, not a few apple growers have never set eyes on the moth alive and busy in the orchard. The little moth is of a very retiring disposition, and rests quietly through the glare of the day. It seldom moves out to flit about the apple and pear trees until "grateful evening mild" steals down upon the earth, and the grower has finished his outdoor work for the day. However, moths which emerge from pupæ inside the storeroom, not infrequently attract his attention, whilst they beat against the windows seeking their freedom.

In a normal season there is only one generation of codlin moth, yet many observers affirm in favourable years another sometimes occurs. It may be so. Certainly the moth is recorded by qualified entomologists to pass through its life cycle, from laying of the egg to the issue of the moth from the pupæ under two months; but the observations stop there. The first brood, it is plain, would have to deposit fertile eggs before the second generation of larvæ could appear, and time must elapse to perfect these processes. My investigations have always gone to show the larvæ are very irregular in their development; also the emergence of the moth from the pupæ. The time taken by the female to deposit the whole of her eggs covers a much longer period than is often allowed for by orchardists in applying the poison to kill the infant larvæ.

The species is really a single-brooded one, and corresponds somewhat to the variety of apple the individual affects. Of course there are hundreds of separate broods in a badly-infested orchard, hence the confusion which arises of the so-called double broods. These are now admitted to be simply early or late ones, according to the brood, season, and particularly the situation of the orchard.

A proper habit of a codlin grub is to lie by at its ease within its firmly-fixed and comfortably-furnished cocoon during the winter months, and not to undergo the change to the pupæ until the advent of spring.

Description and Life History.

The pretty little codlin moth expands but three-fourths of an inch across its outspread wings. The forewings are brown, crossed with series of irregular fine grey lines, the characteristic terminal "eye spot" is of a metallic bronze colour; the hindwings are of a coppery hue. When at rest the forewings are folded over the hindwings and body, the antennæ are tucked in, and the full length of the moth is about half an inch.

Early broods of moths are ordinarily out and about by the beginning of October, and they continue to issue from the pupæ till well on in November. Later ones appear in the month of December and even January.

After pairing is over, the maternal instinct of the female moth is displayed by her anxiety to deposit her stock of 50 to 80 eggs, singly, one on each forming fruit, so to provide for her progeny. Two or more grubs in one fruit are probably the offspring of different moths, unusual oviposition, different periods of egg-laying, or the moths were swarming, and very few fruits. There is little room to doubt its proper egg-laying habit is one egg to a fruit.

The flattened white egg is somewhat the shape and size of a doll's pin head. The moth lays it at the base of the calyx, or on the eye half of the young apple or pear soon after it is formed and set, and before it droops over on its stalk. Eggs have been found on other parts, as stalks of fruit, possibly deposited after the fruit had turned down by an individual of a late brood, on leaves in proximity to the fruit, and more commonly on the smooth surface of the cheek of the fruit.

In less than a week the larva hatches from the egg, and the tiny grub nibbles for a few days at the surface of the top of the newly-formed fruit. So it gets a start before commencing to eat its way into the heart of the fruit, around which, secure from interruption, it feeds to maturity. Its bulk of food is the pulp, but it afterwards nibbles at the aromatic pips, which it presumably finds more to its taste.

A full-sized larva measures quite five-eights of an inch in length. The ground colour is white, with a faint pinkish tinge, and a brown patch on the back of the segment next the head. Arranged in regular series down the back and sides are numerous small, raised black dots; from the centre of each springs a fine short hair. It has a shiny dark-brown head, carrying a pair of strong notched jaws, by the able use of which it satisfies a healthy appetite for fruit. The first three segments next the head have attached a pair of true-jointed legs apiece, and the fifth, seventh to ninth, and terminal segments have each a pair of sucker feet.

When a larva is fully fed it eats a way out to gain the open, making an irregular passage through the cheek of the fruit. Should the grub wish to vacate the fruit while it is hanging on the tree, it lowers itself to the ground by a silken strand it spins for the purpose. For the larva to leave fruit lying on the ground or in a fruit case, all it has to do is to bite through the rind and to crawl out.

After the grub has left the fruit it roves in search of a secluded site to build of small pellets of wood and *débris* woven together its tough, silken-lined oval-shaped cocoon. In the orchard beneath the loose bark on old trees seems a favourite place for it to choose, and on low standards it prefers a position about the fork and main limbs. It is also found on old rough rail fences in the post holes and similar places. Inside a fruit-case it gets either between the joints or in the corners. The worst of the roving spirit the larva shows is that it will sometimes leave the fruit-case and go into any other cover that happens handy. A resting period more or less extended follows. The larva, swathed in its cocoon, metamorphoses to a pale brown pupæ with rows of short spines on its back. About a fortnight later the pupæ will force its way partly out of the cocoon by the aid of its spiny back. The pupæ splits open and the perfect moth steps out, and so the life round of the insect is completed.

SUGGESTIONS.

Where the codlin moth is prevalent in a fruit-growing area all that can be conscientiously recommended to fruit growers and bodies controlling these

matters, is the introduction of its chief ichneumon fly parasite, *Calliephialtes messer, Gravenhorst*; and, so as not to kill the parasite, compulsory cessation of mechanical operations against the pest. The ichneumon fly is a medium-sized one, and like the generality of its kind of an exceptionally hardy nature. It is stated to be especially vicious and severe in its attacks on codlin moth, and to multiply rapidly at the expense of the grub; thus the loss caused by codlin moth depredations becomes quickly reduced and kept down to a minimum, and the expense and trouble of applying ordinary remedies obviated.

In the event of the supply of parasites not filling an immediate demand for them, the most successful methods for coping with the pest in infested orchards are herein detailed :

To poison the young and delicate caterpillars while feeding about the surface, and cut short their mischievous careers before they burrow into the fruits, spray at regular intervals with Paris green. Once, either when the trees are in bloom or immediately the petals have fallen, and again later when the baby apples form and before they turn downwards on their stalks. The rains are usually over by this time in Western Australia, but in the event of a downpour after spraying it would be as well to do the work over again. For the Paris green spray, used successfully by the Department, the ingredients are:—1oz. Paris green, 8oz. unslaked lime, 2oz. treacle, 10gals. water. The mode of mixing is:—Mix the Paris green powder to a paste in cold water. Place lime in billy, and cover with boiling water to slake it. Strain these mixtures through a fine gauze sieve into the water to keep out the grit. Add the treacle, and thoroughly stir the solution.

To trap the full grown grubs bandage the trunk of infested trees with two pieces of sacking or clothing, one a foot and the other three feet from the ground, to catch the grubs which crawl into the folds of the bandage or between it and the trunk to make their cocoons and to pupate. These bandages should be carefully examined weekly, and also the trunk of the tree where the bandage has been, and any grubs found should be immediately destroyed. Soaking the sacking in boiling water will be found the surest way of doing this. A quick way to make and fix these bands is to take a strip of sacking about a foot wide, and wind it round the trunk of the tree, afterwards tie this round the middle with a piece of rope or string to the stem and fold the top half over. This makes a more satisfactory trap than a single piece of sacking tied round the bole of the tree.

At the end of the season make a general clean up of all rubbish, remove the bandages and limewash the trunks and main limbs. In old orchards scrape off loose old bark from the stem of the trees so as to destroy shelter for the grubs. Pieces of bamboo laid about on the ground beneath the trees would tempt the larvæ to pupate in, and at the right time could be disposed of by burning.

Windfalls should be collected and boiled to feed the pigs. In small orchards the diseased parts of the fruit may be cut out, and the grubs thrown into boiling water. This should be done daily, as the shock of the fall of the fruit from the tree often causes the grub to leave the fruit hurriedly, and many apples may sometimes be examined before a larvæ is found.

Pigs, sheep, or horses might be given the run of the orchard, in some cases in order to eat the fallen fruit and the grub. Keep the ground in the orchard clear of rubbish and well cultivated.

When the fruit has been disposed of, the store-room should be strongly fumigated with sulphur and thoroughly cleaned and limewashed every year as a further safeguard. All old fruit cases, litter, and refuse about the place should be burned.

In the neighbourhood of a known codlin moth infested orchard, or even one thought to be infested, exercise the greatest vigilance not to have anything conveyed from it to your own likely to bring the moth. Infection is easily carried, either as larvæ in the fruit, as larvæ or pupæ in the joints and corners and cracks of second-hand fruit cases, or potato sacking.

BACTERIA AND PLANT LIFE.

EIGHTH LECTURE.

By Dr. Blackburn, Government Bacteriologist.

The importance of the place occupied in the economy of nature by bacteria is so great that one who has not studied them would probably be surprised to learn that these "unseen hosts" perform one of the most important of the great chain or series of processes that go to make up the mysterious cosmos of which we and they and all other living things are parts—each with its allotted *rôle* to perform. "Importance" is indeed hardly a fitting expression to use here, for, without bacteria, first plant life, then animal life would cease to be, so that they are essential rather than important in the scheme of nature as we know it here, and in the following remarks I will endeavour to explain how this is. On account of their connection with disease they have rather a bad reputation in the minds of most people, but this is hardly fair. It is indeed their relation with disease that first brought them into prominence and caused them to be carefully studied, but since then it has come to be recognised that the comparatively very few bacteria which cause disease do so by virtue of what are probably highly specialised properties, accidently acquired in the course of time and in the struggle for existence, and that the benefits conferred by their activity infinitely outweigh the harm done by a few of them. The latter are indeed carrying out their appointed function in nature, though the usefulness of it may not be obvious to us. The more we look into the matter the more it would appear that in every thing in this world—in the spheres of physics, of biology, of sociology, and even of metaphysics, nature is a system of opposing, or, more correctly, balancing forces, the complement of which is leading us—to the millenium?

It is in relation to agriculture that bacteria play their great part in nature; but before going on to describe the processes in detail, it might be well to describe the bacteria themselves, giving some account of their structure and vital processes.

Bacteria are unicellular organisms, the most lowly-organised members of the vegetable kingdom. The word unicellular may be more fully explained. Everything living, animal or vegetable, is made up of cells or the products of cells—just as a brick wall is made up of individual bricks. As the brick is the structural unit of the wall so is the cell the physiological unit of the living structure. The difference between the cells of highly-organised animals and those of unicellular creatures is that, in the former case, different groups of cells take on special functions: one group digestion,

NARROGIN.

E. A. Cameron's Farm. Stock Paddock, "Manaring."

another sensation, etc., etc., while obviously the single cell—of which the unicellular creature is composed—has itself to carry out all the functions necessary to its existence. Bacteria, then, consist of a single cell, and they are considered to belong to the vegetable kingdom.

They exist in three fundamental shapes:—

(1.) The simplest possible, a sphere or ball. These spheres, each known as a "coccus," may remain quite separate or may be grouped together in various ways—in pairs, clumps, or chains.

(2.) Elongated or rod-shaped structures, what is properly referred to as a "bacillus." This may be of various degrees of elongation from an oval to almost a thin filament.

(3.) The rod may be curved or spiral, forming what is called a spirillum.

They are very minute. We can hardly realise how much so. On the average it would take about 15,000 of them to stretch the length of an inch.

They live by taking fluids into their substance and extracting from them what they require for their nutriment; thus they must be in at least a moist environment, and in the absence of moisture bacterial activity ceases. They also form substances known as ferments just as do the higher animals. We are familiar with those formed by the latter, as pepsin, rennet, etc. The function of these ferments is to modify organic substances so as to render them assimilable or directly fit for food for bacteria. It is in the performance of this function of assimilation that they are such a powerful force in nature, as will be explained later; their food is always dead organic matter of some sort.

Their method of reproduction may be referred to as of general importance. When bacteria find themselves under congenial conditions with plenty of food material they proceed to multiply. This is for the most part a simple process of fission or division, the structure simply divides into two parts, each similar to the parent. Under favourable conditions this process is repeated by the new individuals in from 20-60 minutes, so that it will be seen at once that multiplication is a marvellously rapid process with bacteria; for, obviously, starting with one individual, at the end of an hour there will be two; at the end of another hour four; at the end of another hour eight, and so on till at the end of 24 hours it is 16,000,000. As a matter of fact conditions hardly ever allow of such increase under natural circumstances, though it probably often occurs under laboratory conditions, which are very different.

Now, before going on to explain the result of the activities of bacteria, it is necessary to refer to some of the chemical relations of organic and inorganic substances, though this has probably been more fully explained by Mr. Mann in his lecture, etc. Certain substances are necessary for plant life, the principal being nitrogen, carbon, water and various minerals, as, sodium, potassium, etc. The first, of course, forms the greater part of the atmosphere, but cannot be assimilated by plants in the simple "uncombined" form in which it exists there—they can only assimilate it in the form of nitrates and other compounds in which it is combined with other elements, which they obtain from the soil, as they do some of their carbon. Another source of their carbon is the carbon dioxide of the air, which is taken in by the leaves of plants, where it is broken up into carbon and oxygen; the carbon is retained and built up by the plant into its substance, while the oxygen is returned to the air. The water and minerals in the form of

"salts" are also obtained from the soil. Now, under natural conditions, nitrates, as such, are never put into a soil, but of course various forms of organic matter are. Then whence arise the nitrates? The answer to this is that bacteria seize upon the organic matter and form from it the simpler nitrogenous compounds, of which a nitrate is a typical example. Thus crude organic material, which is in a way essential for plant life, requires to be profoundly modified before it is of any use to them, and it is bacteria which carry out this modification. This process of modification of dead organic matter is really what we speak of as putrefaction, a very common process which goes on wherever dead organic matter exists.

This property of modifying dead organic matter is really the great function of bacteria in nature; other properties which a few of them may possess being accidentally acquired as mentioned above. This process is necessary to the continuance of the cycle of nature, as I will proceed to explain.

I have shown how plants require nitrogen, and can only assimilate it as simple chemical compounds like nitrates. Now, animals require nitrogen also, but they need it in the shape of the complex nitrogenous organised matter into which the plant has built it. So it is that animals turn to plants for part of their necessary nitrogenous nutriment, which they again build up into the more varied nitrogenous materials of which their bodies are composed. During the life of animals they are excreting nitrogen and carbon, which return to be assimilated by plant life, and after death their bodies are broken up by bacteria to follow the same course and set the nitrogen on its cycle again. It will be observed that there is a building up of the nitrogen by different steps from the simple nitrogenous salt (nitrate) to the complex nitrogenous materials of which the animal body is composed. It is thus evident that eventually animal bodies will have taken up and kept locked up in them all the fixed or combined nitrogen available in the world, so that plant life in its turn would have been starved but that bacteria came in once more to make it available for plants. It is in this way that bacteria are so essential, as I said above, in the economy of nature.

Now, it must be explained that this putrefaction is not the simple process that might be inferred from the above remarks. Very many different kinds of bacteria take part in it, and very many and various chemical and physical changes occur. Each different kind of bacteria takes the process a short step further, but certainly no one kind takes it all the way.

Many different bodies result from this process, among them various gases, which indeed are very obvious in a dead body or putrefying fluid. Now, among these gases occurs free nitrogen, which, as I have mentioned above, is useless for plants or animals, and in respect to which (as a product of putrefaction) the process has been carried too far; the nitrogen which has been combined and so made available for living structures has been returned to the atmosphere. But the evolution of nitrogen is an almost invariable concomitant of putrefaction, and is probably a sort of accidental by-product.

Thus, in the natural course of events, some of the store of combined nitrogen is constantly being drawn upon, and, in the absence of any counter-balancing process, this store would soon fall short of requirements, and both plants and animals would be in danger of starvation. Here, again, bacteria come to the rescue to preserve the balance, and in a very interesting way, which has only been worked out during the last few years, and which I will now explain.

If the roots of a certain class of plants—the leguminous or pod-bearing—be examined they will be noticed to have on them a number of excrescences or "nodules." These were once thought to be a disease like galls, but it was subsequently found that these nodules were full of bacteria. It was noticed that they were of a different shape to any known bacteria, being V and Y-shaped, besides the usual rod or sphere, and for that reason they were thought not to be true bacteria and were hence called bacteroids. Subsequent research showed, however, that these shapes were merely variations, and in the laboratory these bacteria have the usual appearance. Now, this particular class of plant had always been noticed to enrich soil (as far as nitrogen was concerned) rather than impoverish it, for which reason they have long been used as alternate crops and green manure. Further investigation showed that the bacteria in the nodules are engaged in fixing the free nitrogen of the air, combining it with other elements to form nitrogenous compounds available for the plants. Exactly how this is done, whether the bacteria alone do it, or whether the plant and the bacteria together do it (symbiosis), are still matters of discussion, but the fact remains; and these are the bacteria which are returning to plant life the free nitrogen from the air and keeping the balance against those bacteria which in the course of putrefaction are returning it from its fixed condition in organic substance back to the air.

These various processes are shown plainly and graphically in the following scheme or table (taken from Newman's "Bacteriology"):—

A SCHEME SHOWING THE PLACE AND FUNCTION OF THE ECONOMIC MICRO-ORGANISMS FOUND IN SOIL.

Water. — *Chemical Substances.* [Nitrates, etc.]. — *Gases.* [CO_2,H,N,O].

PLANT LIFE.

- Carbohydrates [albumoses, sugar, starch, etc.].
- Fats.
- Proteids [bodies containing Nitrogen].
- Vegetable Acids.
- Mineral Salts.
- Water.

Proteids → ANIMAL LIFE.

- Gases [CO_2, etc.].
- Water.
- Urea, Albuminoids, Ammonia compounds, etc.
- Nitrogen in many forms locked up in the body.

Urea, etc., and Nitrogen in the body → PUTREFACTIVE AND DENITRIFYING BACTERIA.

- Free Nitrogen.
- Gases [CO_2].
- Water.
- Ammonia, and other elements of broken-down complex bodies.
- [Nitrites.]

Free Nitrogen → NITROGEN-FIXING BACTERIA. [In soil and in the nodules on the rootlets of *Leguminosæ.*]

Ammonia and Nitrites → NITRIFYING BACTERIA.

Nitrites [= Nitrous organism (Nitrosomanas)].

Nitrates [= Nitric organism (Nitromonas)].

[In soil and available for plant life.]

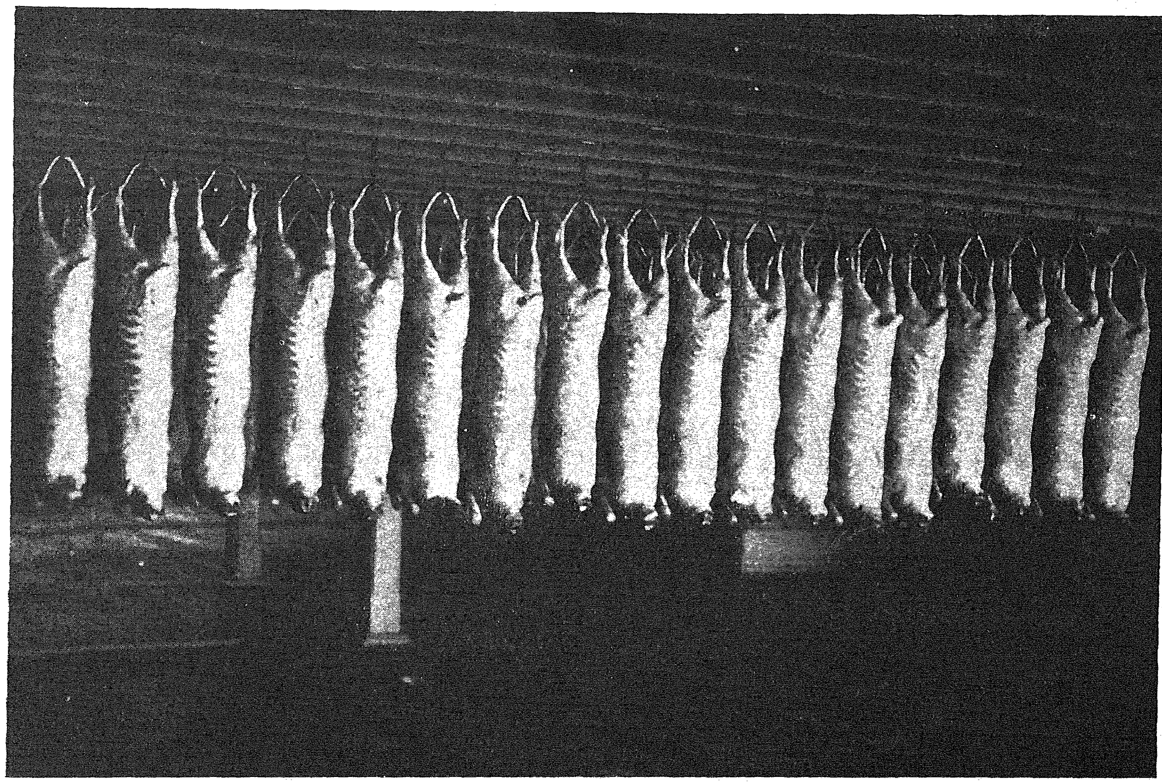
This table practically explains itself, but may be read as follows:—The substances mentioned in the first line are taken up by the plants to form their structures with, which structures consist chemically of the bodies mentioned in the next line, which as vegetable food are taken up and utilised by animals in the same way to form the substances mentioned in the next line. During the life of the animal the urea, etc., which it excretes, and, after its death, the complex nitrogenous substances of which it is composed, are broken up again by putrefactive and denitrify bacteria into the simpler substances of which the simplest, the free nitrogen, is acted on by other bacteria again who combine it to make nitroles, etc., and other bacteria again attack the ammonia, etc., and form similar substances, which are then ready to begin the cycle again, as shown at the top of the table.

That completes all I have to say about the functions of bacteria in relation to plant life. I must next refer to the practical use which has been made of the discovery of the nodule bacteria. It was soon thought that it could be put to practical use if the bacteria could be cultivated and added to the soil where the leguminous crops are to be planted. It was found that they could be grown, but for some reason it failed of practical application. Then Dr. Moore of the U.S.A. Department of Agriculture spent some years investigating the matter, and eventually perfected a method of cultivation and practical application of the bacteria, from which the farmers in America have derived much benefit, and at latest he reports something over 70 per per cent. of successes.

We are making some experiments and carrying out some investigations here to see if we can do anything of the sort in Western Australia, but a matter of this sort cannot be worked out quickly, and may require a year or two's observation and experiments before it can be said what advantage can be derived from it.

The result of the successful inoculation of a crop is greatly increased yield, the same, if not better, as would have resulted from the application of a liberal dose of a good, easily assimilable manure (nitrogenous), which of course would be an expensive item, whereas the inoculation is certainly not an expensive matter; hence the advantage, not to mention the difference of labour involved. It might be well to repeat that this method is not applicable to cereals, etc., other than leguminous crops, *e.g.*, peas, beans, lucerne. The advantage is in getting a heavy leguminous alternate crop which can be used as green manure for the cereal which is to follow it.

I will conclude by referring again to the fact that bacteria are capable of causing disease—among plants as among animals. Some bacteria seem to have acquired the power or property of attacking organic matter before it is dead, while it is still a living structure. Bacteria possessing these properties are responsible for several more or less widespread diseases, namely, pear and apple blight, twig fall of olives, various forms of "rot" in hyacinthe, cabbages, and several solonaceous plants; also "bacteriosis" of beets and some garden flowers. Besides these there are certain other diseases still with regard to which the evidence as to their bacterial nature is inconclusive and requires further investigation.



Usual run of Carcases before Grading.

COLD STORAGE.

NINTH LECTURE.

By Allan D. Cairns.

Fruit.—The crop of fruit in Western Australia is harvested from January to June. Should we at any time have a surplus for export, we must keep in mind our South African neighbour, who, thanks to the efforts of the late Cecil Rhodes, has established a fruit trade with London of considerable importance. Our fruit could be placed in the British market before the home and continental crops are available. Following these in the British autumn, cold storage fruit from America in great quantities takes the market and holds it practically for the remainder of the year.

A few years ago there were, of course, gaps in this cycle, during which time prices rose to a very high pitch.

The change has been brought about by the aid of mechanical refrigeration, and the grower, whether he be near the distributing centre or plodding along up country, in Australia or the Cape, need have no fear so long as he has the quantity and quality.

Cape fruit growers replanted with the best procurable stock, brought from as far away as Japan even for plums. Mr. Cecil Rhodes, a great cold storage enthusiast, took the matter up in a wholesale manner. He bought 45 farms in the Paarl and Stelenbosh districts, where soil and climate favoured the project; and, profiting by this experience, he planted (under expert advice) the fruits most suitable for his purpose. Last year 22,000 boxes were sent to Great Britain, grapes, plums, and peaches being the most numerous.

If anything profitable is to come out of fruit for the growers, it is well to look ahead. Varieties best suited for cold storage and transport will have to be cultivated. Growers will stagnate if outlets are not provided; but encouraging prices do not always follow a trial shipment, and although we may not be as fortunate as South Africa in having a Cecil Rhodes to infuse life into the question and money if need be, we have the results of the neighbouring States to encourage us to persevere. High-class fruit will sell anywhere at any time. We here would have the advantage of being able to both grow good fruit and ship it at a time when most of the world's fruit raisers are out of the market. The advantage of living at the front door of Australia as well as the last port of call, and then only within four short weeks of the world's greatest distributing centre by mail steamer, will be a factor of success in the possibilities of the future.

Our cold storage products will then, besides being the shortest time in transit, will naturally be nearest the hatch, and find their way soonest to the consumer.

Plenty of cool storage space is available, both in Perth and Fremantle, at all times of the year, sufficient to demonstrate to the grower the keeping qualities of the fruit.

Before reliable data on the keeping qualities of each particular kind of fruit from the various districts can be obtained, careful experimental work will have to be undertaken. The climatic influence, together with rainfall and

soil peculiarities, all affect the keeping properties. The time is now ripe for growers with a surplus to seriously consider the advisability to carefully select a few cases of each kind, and spending a few shillings per case on experimental work. Cool storage cannot be run entirely on a philanthropic basis while we have to pay about 6s. 6d. per ton haulage on coal from the pit.

Growers know full well that beauty is only skin deep, but the best looking always fetch best prices. To preserve the beauty of their comodities, and place them on the consumer's table as fresh and fragrant as when they left the orchard, requires cold storage buildings and machinery of the most costly type. If we are ever to rise to great things in fruit storage for ourselves for off-season requirements, or step into the arena of competition with our older and more experienced, although not better equipped, competitors, work should begin as soon as possible.

Eggs.

Eggs that are to be kept for a few months must be fresh and as nearly new laid as practicable at time of storage. Infertile eggs are superior to fertile eggs for cool storage.

Should fertile eggs become heated up to near the incubation point, the life germ will become active, and no subsequent care will restore absolute freshness. By daily gathering and storing in a clean cool cellar or shade all the cleanest and best-coloured eggs, and keeping them dry in an odourless box or basket, the best results are obtained. Washing off unsightly stains, or any contact with water, is condemned by experts, as the "bloom" is destroyed.

As eggs loose weight by evaporation, in common with all cold storage goods, provision for air circulation in the cases by wiring the pasteboard filler and ventilated case is imperative.

Eggs in cold storage are very susceptible to stale odours. The water glass or silicate of soda treatment is supposed to cure it by completely closing the pores. This practice is permissible for household surplus, but the washing off of water glass spoils the look, as the bloom has gone.

No egg-stained packing is permissible when the ultimate success of cold storage is to be considered.

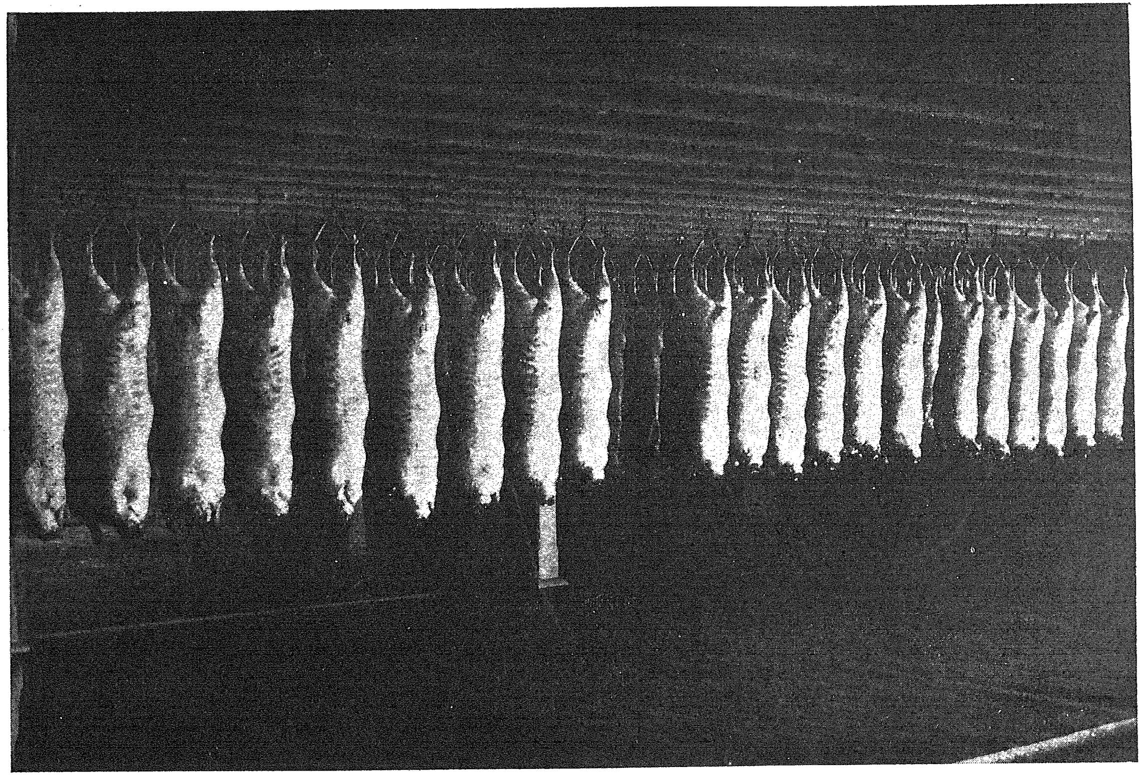
Eggs, like cream or butter, are a delicacy that can be tainted by tobacco smoke, and thereby lowered in value.

Fresh eggs cooled down to cold-storage temperature have the white sufficiently congealed to keep the yolk in the centre. Should any doubtful eggs be found on occasionally sampling the cases the cases must be turned over periodically. Watery eggs and those that are greenish are useless. Eggs known as "blacks" or spots, or in fact any disfigurement or fault that detracts from their look or taste, spoils their chance of success from the cold storage man's standpoint.

Lambs.

Lambs promise to be an important item of the exports of our State in the near future. They are found to thrive from Port Hedland in the North right down to the southern seaboard, Ashburton.

All the neighbouring States export lambs with profit. New Zealand, of course, leads with her two millions. Tasmania will soon be heard from;



Carcases after Grading. First lot, 43 to 56 lbs. each ; second lot, 37 to 42 lbs. each ; third lot, 28 to 36 lbs. each.

in January of last year she began with a 40-ton lot. Our season fits the London market splendidly. High prices rule in January and February, but the conditions are exacting.

Lambs are a tender subject for cold storage. Great care in breeding and feeding must precede careful, cleanly killing and dressing. Immediate proximity of the chill-room to the abattoir is imperative—the shortest possible distance from cold store to ship to keep us in line with our neighbours.

New Zealand's charges are about $1\frac{7}{10}$d. per lb. This includes freezing, freight, insurance, exchange, and selling charges. Queensland works to encourage the trade, will treat them for a fraction over 1d. per lb. to owners.

A Government produce depôt at ship's side, as at Adelaide and elsewhere, will be a splendid thing for the State. All grading and inspection must be under State oversight, so that no inferior stuff can tarnish our reputation.

The United States, Canada, and all our neighbours jealously watch the export trade through the eye and brain of their respective Agricultural Departments. Our Agents General at the London end post us on markets and keep a watchful eye on our interests.

Good Shropshires seem to hold pride of place in Australia for their many good qualities, both to freeze and to thaw out. A lamb, to stand freezing for two or three months, must possess enough outside fat to set well after thawing and look bright and attractive.

Merinos are leggy and look dark after defrosting, and carry too much fat on the inside.

Shropshire or Lincoln crossed on a big merino ewe make a fairly good lamb (Weir); "combacks" from these strains also offer possibilities not to be despised.

Lambs costing $3\frac{3}{8}$d. on hoof and selling in London at 5d. to $5\frac{3}{4}$d. allow a fair margin, but the average weight and condition of the whole mob and its proportion of first-grade stuff is the point to be first kept in view by the buyer for the cold store.

Lamb growing, so successful in New Zealand, owes a great deal of its success to small holdings, and close attention by an intelligent farming community. Contrasted with Argentina, where meat operating works buy sheep and lambs by the ten thousand from the ranch holder, leads one to suppose that quantity is of more importance than quality to the South American grower. A look at the ruling prices for South American mutton in London bears out this argument. On the other hand, New Zealand meat works treat mutton and lambs for the owner at so much per lb. This method equally distributes responsibility as well as profit. It will be seen that it pays the small holder to grow 50 fine lambs which will go over 5d. per lb. better than 100 at 3d. This system has been enthusiastically taken up by the Downs farmers in Queensland, and it is now no unusual thing for them to place a prime 30lbs. lamb into the works 16 weeks old. Although such results may not be attainable in W.A. for some time, still the small holder, by strict attention to breeding and feeding, may develop prime lambs that may yet lead Australasia for quality and flavour in the London market.

DAIRYING.

TENTH LECTURE.

By Percy G. Wicken.

On October 13th, owing to the absence of Mr. Andrews, the lecture at the Department of Agriculture was given by Mr. Percy G. Wicken, who chose "Dairying" as his subject. The lecturer stated that owing to the fact that we import immense quantities of dairy produce the subject should be an interesting one. Last year this State sent away £397,000 for dairy products, the bulk of which might have been raised in the State and employment afforded to a large number of people. A good cow suitable for a dairy herd should yield an average of 6C0 gallons of milk during the milking period. This is not an excessive yield, as instances of a cow yielding 1,100 gallons are on record, while we have records in Australia of a herd of 90 yielding 525 gallons per head, or a herd of 12, 866 gallons per head. The test as to whether a cow is profitable or not is soon ascertained by means of the scales and Babcock tester. A set of scales should be attached to every dairy, and a set fixed up next to where the milk is received were shown in the picture showing the milk-room. The various breeds of cattle suitable for dairying were next dealt with, these breeds being the Milking Shorthorn, Ayrshire, Jersey, Kerry, Holstein, Red Poll. The special points of each for dairy work were stated and typical animals of each breed shown by means of a lantern. The composition of milk was then explained, and drops of milk highly magnified were shown. The different means of separating the cream were next explained both by deep and shallow setting, and by means of machinery. Pasteurising the cream and milk and adding the proper cultures to give the butter the correct flavour, the methods of making butter, salting and working the same, were demonstrated. Cheese-making also formed part of the lecture, and the methods adopted for making Cheddar cheese were explained, and lantern slides showing each process were exhibited. Cheddar is the principal cheese made in Australia, but the process of making Stilton and several soft cheeses were touched on.

WINE-MAKING AND WINERIES.

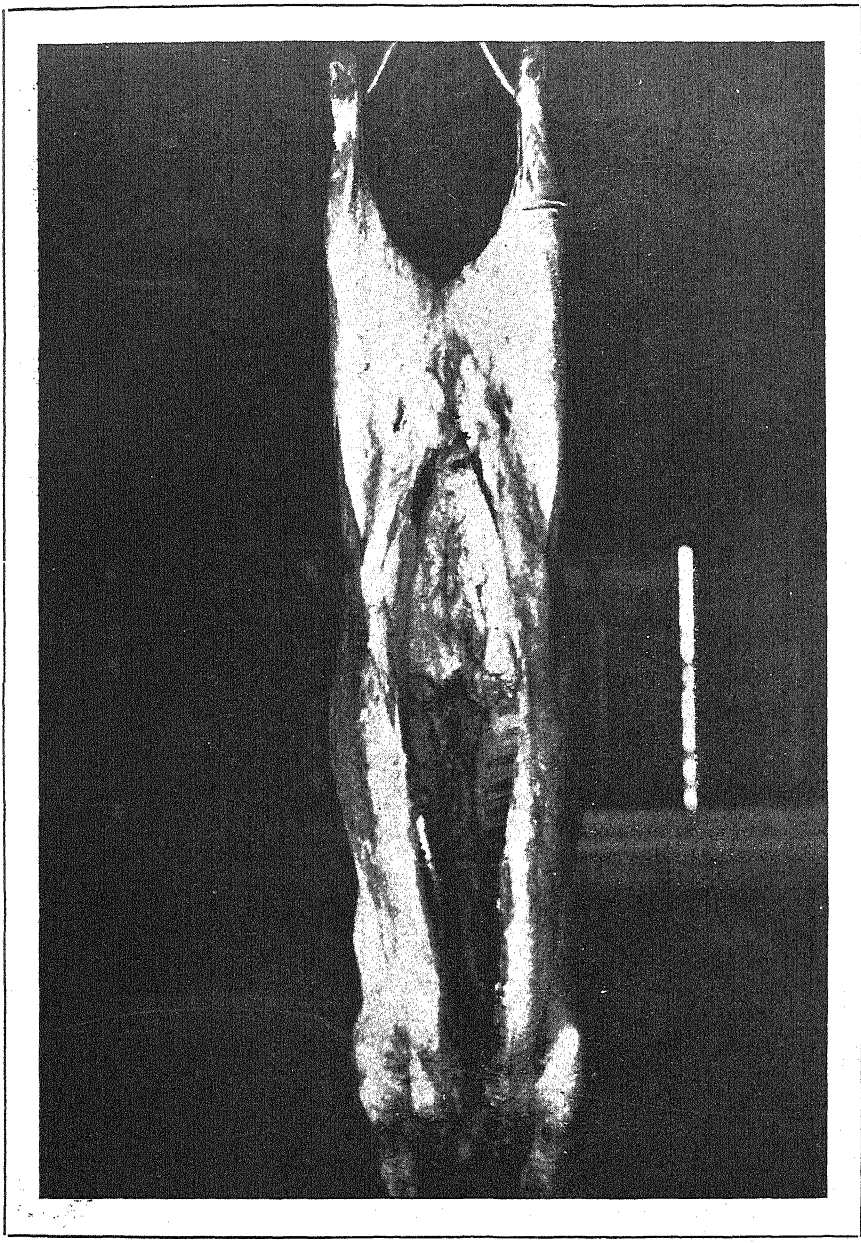
ELEVENTH LECTURE.

By A. Despeissis.

One of the most interesting lectures of the series was given by Mr. A. Despeissis, the Horticultural and Viticultural Expert, on Wine-making and Wineries.

Grape Juice and Wine Complex Substances.

The lecturer asked his audience to bring their mind to bear on a bunch of grapes, then single out one berry on that bunch. On making a section of that berry it was found that in the top was the fruit stalk that attached



Model Shropshire. Front View.

the fruit to the bunch and exposed it to the influence of light and air, and also carried food and substances that, under the influence of sunlight, helped to build up the seeds in the centre, the sweet-pulp which surrounds them, and the skin which envelopes the whole. During the ripening process there was a transformation of tartaric acid in solution in water into grape and fruit sugar; under the skin is found tannic acid and also cells containing in some grapes, like the Muscats, aromatic essences, while other cells contain pigments, which colour the wine when dissolved during the process of fermentation by alcohol, under the influence of warmth. Besides these substances are also albuminoid bodies and mineral matters, which all help fermentation, and are finally cast away from the wine after it is made. Outside the skin is a waxy bloom, in which, when the grapes are ripe, are embedded great numbers of germs. Some of these germs are beneficial and are the active agents of fermentation; they are called yeasts or levures; others are injurious, and, unless checked, invade the wine sooner or later and cause trouble; they mostly consist of bacteria.

During the process of fermentation fresh combinations of substances resulted, and spirits, acids, and ethers were formed, which were very unstable bodies and were easily destroyed.

It is seen that grape juice and wine were very complex substances, and that for that reason they were not easy to handle without danger of losses. In handling them more than skilful treatment was necessary, and the wine-maker should have some technical knowledge of the raw material he was handling, and of the forces which operate changes in its composition during, as well as after fermentation. So long as everything goes on satisfactorily there is apparently nothing easier than wine-making; all the elements of good wine were in the grapes, and under favourable conditions nature made good wine, and the wine-maker could take little credit for the achievement. Where his use came in, however, is when trouble arises, and it is then that both skill and technical knowledge can ward off disaster.

Qualifications which insure Success.

That being so, it is seen that, although a man may be a very diligent and careful and painstaking farmer and vine-grower, he may lack in the qualifications which are essential in a wine-maker. Even if it happened that a grower is also an efficient wine-maker, the result of his industry and special knowledge is often spoiled by his want of business training and that natural shrewdness which helps in competing in the open market. For these reasons, therefore, the complexity of the raw material which wine is made of, and of the wine itself, as well also the unlikelihood of the bulk of wine-growers embodying in their several selves the qualities which characterise a good cultivator, a skilful manufacturer, and a shrewd business man, it is seen what poor chance of success the average wine-grower has under the conditions which at present govern the wine-growing industry in this State.

Lack of Capital no bar to Success.

Another disadvantage which the individual grower labours under is, as it too often happens—lack of capital. Perhaps it is a good thing that it should be so, as it is only too true that no amount of capital will go the length of some people's extravagant conceptions and extended ideas. However, under proper organisation, whereby full security would be insured, the individual grower can not only be offered the use, at a nominal cost, of

accommodation for his wine, and of appliances for handling it, but he may also borrow on his goods, and thus not only keep afloat but go on extending his operations.

Advantages and Benefit.

Instead, therefore, of every individual unit of a wine-grower wasting time, money, and energy in striving single-handed to make both ends meet by cultivating, by manufacturing, by retailing, and by financing his goods, it would be better by far to co-operate; or to organise things in such a way that the burden of each of the steps rests with people specially trained and accustomed to the use of appliances which would do the work with success.

By means of proper organisation, and not necessarily co-operation, there would be greater economy in handling either grapes or wine. Instead of a lot of small plants, one capacious set of machinery and appliances would do the work with greater speed and at a reduced cost.

Greater uniformity in the types of wine turned out would also result, and would make large deals possible. This would be effected by skilful blending and timely filtering and pasteurising in large bulk. In large central wineries, be they capitalistic or co-operative, it is, besides, possible to employ a specialist, called an œnologist, who takes at frequent intervals samplings of the wines for tasting as well as for laboratory examination under the microscope, and also by means of chemical tests.

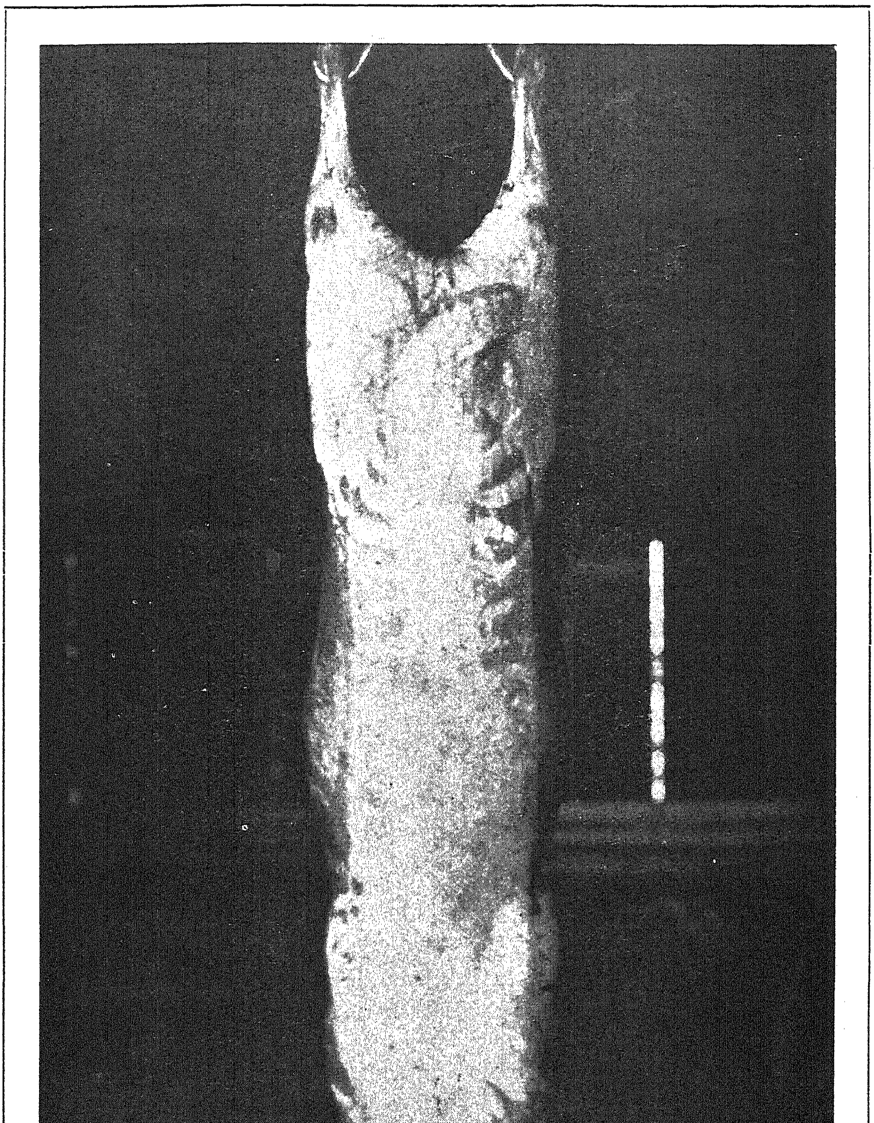
Last, but not least, the owner of a parcel of wine generally finds it easier to borrow on goods stored in such cellars than he would if he had the sole handling of it in his own small cellar. Co-operative wineries or central organisations are generally empowered to advance on the goods stored until a good market is found.

Difficulties and Dangers.

Co-operation, however, which is the ideal system of equitably distributing to each contributor to a winery his share of any profit, is by no means easy to organise. In the first instance vested interests have to be considered. People who have cellarage accommodation, plant, stock, and a circle of customers dealing with them require more consideration in adjusting any profit available for distribution than people who simply supply grapes or young wine. Then, again, there is the disinclination on the part of the successful grower to surrender his business, stock, lock, and barrel to be experimented upon by untried hands. The services of experienced and level-headed directors are not easy to get. Cranks and political jobbers are the most undesirable amongst them. Difficulties of another nature refer to the appraisement of the value of the kinds of grapes or wine contributed to the winery. These difficulties, however, are now dealt with according to equitable formulæ, above or below a certain standard based on the amount of sugar in the must, of acidity in the must, the variety of grapes, and their condition and quality. These methods enable to pay for grapes at their just value, and have been found to work satisfactorily in established wineries.

Types of Wineries.

Co-operation is not everywhere possible, and in many places large cellars or general wine stores have been put up by capitalistic enterprise which are found to work satisfactorily and have offered the relief to the wine industry which it was seeking for. Mr. Despeissis then, by means of lantern slides,



Model Shropshire. Back View.

described a large "communal cellar" at Montpellier, which was recently put up by the municipal council for the purpose of storing any surplus wine stock, and thereby steadying any sudden fluctuation in the market price of the wine. Also the mammoth cellars of the "General Wine Stores," of Beziers, which go one step further than the "Communal Wine Stores" of Montpellier, where vineyard proprietors only store wines at their own risk, and simply have the use of storage vessels and of the necessary cellar appliances. At Beziers, the management undertakes to store the wine, blend, filter, pasteurise it, and attend to all the requirements and operations of the wine trade. Thus vineyard proprietors and wine merchants alike are offered a chance of starting operations without the initiative encumbrance of a cellar or of reducing their establishment. The storage is effected in ferro-concrete vats, in which ullage is greatly reduced. The management is responsible for loss due to neglect of its staff. An œnologist makes a daily inspection of the contents of the wine vats. Special facilities are afforded for consigning the wine either by water to the ship-side at the ports of Bordeaux or of Cette, by means of the Canal du Midi, or by railway, alongside of which the cellars also stand. Any or all the requisite operations can be done according to a very moderate tariff, and these general wines' stores are introducing quite a revolution in the time-honoured methods of wine storage.

Mr. Despeissis then gave an insight into methods of handling grapes and wine in large cellars in Algeria, in Spain, Portugal, the Midi of France, and also around Bordeaux and in Burgundy. In each locality visited he endeavoured to visit some typical wine cellars, and he had been fortunate enough to collect interesting photographs as well as valuable notes describing local methods, which, to a great extent, are dictated by the exigencies of the climate and the requirements of the class of trade. These methods of securing cool cellars or of cooling the fermenting grape-must in hot countries were shown; also the construction and advantages of ferro-concrete wine vats were explained and their superiority as well as economy over wood casks for storing young wines were pointed out. Where, on the other hand, more costly wines of high quality were produced, such as the sherries of Spain, the port wine of Portugal, the clarets of Bordeaux, or the burgundies of France, the time-honoured methods of generations past were in the main preserved. These methods were also illustrated by means of lantern slides.

After reference to the causes which brought about the introduction of the co-operative movement amongst the wine-growers of Germany and of Italy, where "winzerverein" and "cantine sociale" have for some years practically demonstrated the advantages of co-operative wineries, Mr. Despeissis called attention to the remarkable success which had crowned the enterprise of the Italian-Swiss agricultural colony at Asti, in California, and read extracts of an interesting correspondence he had exchanged with Mr. Sbarboro, the organiser and secretary of that colony. As the by-laws of that association show, the idea at first was that it should be strictly co-operative, but when the theory came to be put into practice it did not work. The labourers for whose benefit the colony was founded 24 years ago did not understand the benefits of co-operation, and desired to receive their wages in money, so the stock had to be distributed mostly to business men in San Francisco, who paid on each share of stock one dollar per month for five years. The success of the institution, perhaps the only one of the kind in the United States, was due to its non-speculative principles and the economical and honest management. "We first," writes Mr. Sbarboro,

"accumulated 10,000 dollars into a fund by monthly instalments before we had any land in view. We then travelled all over the State, and selected the property which we thought most advantageous to the association, which consisted of 1,500 acres of choice land in a salubrious climate. The purchase price of the land was 25,000 dollars (£3 7s. 6d. per acre). We paid 10,000 dollars cash, and gave a mortgage for the balance. The land was not inflated in price, as is generally done by land corporations in this country, but put down to the shareholders at the actual cost. Our income from instalments, being 2,000 dollars per month, was used—1,000 dollars to pay off the mortgage and the other 1,000 dollars to grub up trees by the roots, set out grape vines and fruit orchards. At the end of five years, when the shareholders had completed the payment of their stock, we found ourselves with a landed property partly in bearing and out of debt. We then built a winery, one of the largest in the State, and by accumulating the earnings into improvements we have a property now which is worth over half a million dollars over and above its small liabilities."

On the authority of the *Pacific Wine and Spirit Review*, at the time the colony was organised, the price of grapes was $30 (£6) per ton, so the colonists based their calculation on these figures and expected to make a good profit on their investment as grape-growers by selling to the wine-makers.

As soon as the vineyard became productive the price of grapes, however, had fallen to the low figure of from $8 to $10 per ton (£1 12s. to £2), at which price the colony would have been compelled to go to the wall.

Wine, however, was then selling at 20 to 30 cents. (10d. to 15d.) per gallon.

The directors then built a winery, expecting to become grape-growers and wine-makers, and to dispose of their wines to the large dealers each year as soon as made.

Then, again, the colonists were doomed to disappointment.

As soon as their wines were placed on the market, combinations and competition had reduced the price of wine to ruinous figures. The directors of the colony faced the difficulty. Knowing that their wines were amongst the best produced in California, they offered them to dealers throughout the Pacific coast and the Eastern States.

The trade of the colony commenced to increase, and the colonists had to make several additions to their already immense winery, and also set new vineyards on every hill of their extensive tract.

Mr. Despeissis brought his remarks to a close by showing a struggling "cocky's" rustic cellar burrowed into the slope of the Darling Range, not far from Perth. Some of the gigantic cellars shown in the course of the lecture had had quite a modest beginning, under natural conditions less favourable than those found here, where land is cheap and the climate is both favourable and reliable.

DISEASES IN STOCK.

TWELFTH LECTURE.

By R. E. Weir, M.R.C.V.S., Chief Inspector of Stock.

Infectious diseases common to sheep in other parts of the world are practically unknown in this State, and ever since the eradication of scab sheep-owners have had a wonderful period of immunity from anything of a deleterious nature affecting their flocks. Sporadic diseases are also of a minor quantity compared with those contended with in other places, and this may be attributed to the dry climatic conditions which prevail, and the wonderful regulating properties of such plants as the salt-bush, which commonly abounds in those parts where sheep husbandry is more particularly cultivated. These plants withstand the evil results accruing from long periods of drought, and supply nourishment to stock when all grasses have perished, thus being the salvation of many sheep-owners, more particularly when over-stocking has not occurred. Unfortunately many losses have occurred in the past, and are even now taking place, from the presence of poison plants in the pastures in several parts of the State. Mortality from this cause is more common amongst travelling stock, and in those taken on to new country, the owner of which is under the impression that it has been entirely eradicated. "York Road" and "Box" have been chiefly at fault in the latter instances, both of them being of a very poisonous nature, so much so that very little can be done by way of remedial measures when once the poison has gained the circulatory system. It will be interesting to know that the active agent has been extracted from the "York Road" poison by the Government Analyst, and its poisonous effect upon animal life fully established. As engorgement of the lungs takes place from the York Road poison, in the absence of any other remedial facilities, bleeding freely from the "jugular" will in some instances afford relief. It is always well to remember that, when stock are supposed to have partaken of poison, that perfect rest should be allowed, and not until such time as the action of the poison has been destroyed should they be disturbed.

Poison plants are frequently a menace to stock-owners on some of the main and cross roads of the State, and every effort should be made to have these eradicated, as their presence seriously retards stocking, particularly in some of the more favoured parts in the South-West.

Losses attributable to poison plants are not infrequently reported amongst travelling stock, but the trouble is usually due to tynpanitis or "hoven," a diseased condition resulting from an accumulation of gas within the rumen or paunch. This usually happens where a flock of sheep has just completed a long dry stage, and are suddenly brought on to green, succulent pasture. The digestive organs at this time are in a somewhat weakened condition, and are not in a state prepared to cope with any large quantities of nutritious matter. If, therefore, the sheep are allowed to partake freely of the green fodder, the rumen becomes unduly distended, gas is generated, the abdomen becomes very much swollen, the breathing distressed, and movement so difficult that unless relief be immediately given the animal

suddenly falls down and expires. Serious losses of this nature usually occur when a young and inexperienced drover is in charge. The old, tried hand uses precautionary measures, and instead of allowing his flock to partake freely of this tempting feed, he hustles them along; or, in other words, keeps his flock slowing moving, and not until all danger is considered to be passed will freedom to graze be permitted. Where tynpanitis of a serious character is established, and, in the absence of any better instrument, the attendant should not hesitate to use his pocket knife in puncturing the rumen, and allowing the escape of gas. The part selected for this operation should be the most prominent part of the swelling on the left side. No danger is attached to this means of relieving the animal, and the wound usually heals without any injurious effects following. Losses of a somewhat similar character are not infrequently reported amongst sheep depastured in the South-West. The complaint in this instance is more of the nature of enteritis, or inflammation of the bowels, and is not so suddenly fatal. The rapid transit of this class of sheep by vessels from the North, at a period of the year when the herbage is dry, to the southern parts where opposite conditions prevail, is very apt, unless precautionary measures are taken, to result in serious alimentary disturbances. If, however, care is taken, and the animals are placed on sparse dry pasture for a few weeks, or until they become used to the changed conditions, then no injury should follow the complete freedom in the more succulent pasture. Thus, careful management would dispel the present prejudice that exists against this class of sheep for stocking purposes.

During the summer months, travelling sheep frequently suffer from an affection of the eyes known as ophthalmia. This is a severe inflammation of the outer coverings of the eye, usually resulting in blindness of a temporary character. By means of flies, dust, etc., the disease rapidly spreads amongst the flock and seriously interferes with further progress. When this occurs it is always advisable to rest the flock wherever well shaded pasture can be secured, and have the suffering ones isolated. Relief may be given to those by bleeding from the angular vein which runs down the face immediately below the inner angle of the eye.

It is very evident from disorders which are common to the digestive tract, as also diseases affecting the bones of young animals, that a want of lime salts exists in much of the pasture lands throughout the State. One would naturally suppose that the country lying between here and Geraldton, where large deposits of limestone are known to exist, would be well supplied with the salts necessary for the proper maintenance of plant and animal life; but that the opposite condition occurs can only be supposed, from the number of young animals which are cripples from the time of their birth. That a deficiency should occur in such favoured parts can only be attributed to drift or wash from the streams causing a deposit to be laid over the native rock to such a depth that plant roots are unable to penetrate the required distance. Favoured, however, as the State is with enormous deposits of native limestone or carbonate, and the sulphate or gypsum, landowners need never be at a loss to procure, at a very cheap rate, any inequalities which may exist in the soil in this direction.

COMMERCIAL FERTILISERS.

THIRTEENTH LECTURE.

A lecture was given in the lecture hall attached to the Department of Agriculture on Wednesday, October 25, by Mr. Percy G. Wicken, the subject being "Commercial Fertilisers." The lecturer explained the different elements removed by the plants from the soil and from the air, and stated that some were always contained in sufficient quantities in the soil, while others it was necessary to supply; these were nitrogen, potash, and phosphoric acid. The different commercial fertilisers coming under each group were dealt with in order, viz., nitrogenous fertilisers, potassic fertilisers, and phosphatic fertilisers, with the explanation of the source from which supplies were obtained and the percentage of fertilising ingredients contained, and the values of same were explained. The subject of unit values of fertilisers was next dealt with. It was stated that the unit value of a fertiliser was the value of each 1 per cent. of the fertilising ingredient contained, and the method of calculating the value of a fertiliser was shown by means of lantern slides. The difference between phosphates, superphosphate, and phosphoric acid was also explained, and illustrations were given how to calculate the percentage of one from the other. The lecturer then dealt with results of numerous practical experiments carried out in testing fertilisers offered for sale on the markets, and gave tabulated results of the yields obtained from the use of these fertilisers in comparison with the no-manure plots, together with the profit and loss sheets, showing the profit made due to the application of the fertilisers, and in some instances the loss made from same. The concluding part of the lecture dealt with the subject of complete and incomplete fertilisers, and the lecturer explained that it was necessary, in order to keep up the fertility of the soil, to use a fertiliser containing all the elements of plain food, and not one containing only one element. The lecture was illustrated with lantern slides, and at the conclusion a number of samples of fertilisers were shown. Numerous inquiries were made by members of the audience in regard to fertilisers.

HINTS FOR FARM BUTTER-MAKERS.

Always strain the cream into the churn through a dipper with a perforated tin bottom. In winter add just sufficient butter colour of a reliable brand to give a nice yellow tint. Do not depend on pouring it in, but count the drops for a small churning, allowing three or four drops to the pound of butter.

No definite temperature for churning can be given, but the necessity for the constant use of a thermometer must be emphasised. Many conditions influence the temperature of the cream for churning, such as the richness of the cream, the quantity in the churn, the feed and the breed of the cow, the length of time the cows have been milking, the temperature of the room, and the speed of the churn. Aim to make conditions favourable to a low

churning temperature, as it insures a better butter and a more exhaustive churning.

Start with the churn about one-third full, and regulate the churning temperature so as to have butter within 20 to 30 minutes. That proper temperature can only be ascertained by past experience with similar cream.

Poor cream often breaks, but will not gather. Try churning slowly. If this does not overcome the difficulty, the only remedy is to draw off part of the buttermilk to lessen the liquid.

Very rich cream is likely to paste or thicken in the churn, so that concussion ceases. Add enough water at the same temperature as the cream to dilute it so that it will drop.

When the churning is about completed, add a couple of quarts of water several degrees lower in temperature than the cream was. In the summer it may be quite cold. This floats the butter and allows the buttermilk to run off more freely. When the butter is the size of wheat grains it is sufficiently gathered. Look frequently at the inside of the churn lid, and when but few small specks are seen on it, the churning is usually finished. Watch the buttermilk as it runs through the strainer dipper, and if any butter comes with the first streams, a little more churning is necessary.

When the buttermilk is drawn, rinse the butter with a little water, and strain through cheese-cloth into the churn as much water as there was cream. Have the water from 48deg. to 56deg., according to the conditions of the butter and the temperature of the room. In hot weather the wash water may be as cold as possible. Revolve the churn rapidly about a dozen times, and wash but once. We recommend washing butter twice if it has come very soft or has an objectionable flavour, or is going to be packed for winter use.

Salt according to the demand of the market. If the butter is for immediate use and is salted on the worker, $\frac{3}{4}$oz. per pound of butter is usually sufficient. If salting in the churn use an ounce, as not so much is incorporated in the butter. We strongly recommend salting in the churn, as by so doing butter free from streaks can be had with the least possible amount of working, but the churn must be without dashers, and the butter in firm granular form. The only difficulty in this method is gauging the amount of salt. Estimate the weight of butter from the last churning, then weigh the salt. Have the butter evenly spread over the bottom of the churn, sift on part of the salt, tilt the churn forward to cause the butter to lap over, sift on more salt, then tilt the churn backward and put on the remainder of the salt. Put on the lid and remove the churn very slowly until the butter forms in several lumps. It may be taken out and immediately worked, but if possible it is much better to allow it to stand either in the churn or in a tub, if the churn is in too warm a place, for two or three hours, and then give one working.

If salting on the worker, take the butter from the churn, weigh it, and allow $\frac{3}{4}$oz. of salt per pound of butter. Spread the butter over the worker, sift the salt on evenly, fold the salt under and begin working.

For the farm dairy there is nothing nicer than the V-shaped lever butter worker. It is not expensive and is a great saver of time and strength, besides preserving the grain of the butter.

Work by means of pressure only; avoid a sliding motion as it makes a greasy butter. Work sufficiently to expel the moisture and thoroughly

EAST NARROGIN.

Mr. Sol. Fisher's Homestead. "New Jerusalem."

distribute the salt. Any portion of the butter not reached by the salt will be light in colour.

If the butter is very soft or very hard, work out slightly, allow it to stand, and when at the proper firmness give it a second working.

Keep the butter in a cool clean place and get it to the consumer as soon as possible.

Clean all tin dairy utensils by first rinsing in warm water, then clean inside and out with a brush and hot water in which a cleansing material such as washing soda is dissolved. Lastly, rinse with plenty of boiling water and leave inverted in pure air and sunshine, when available, until wanted for use.—W.L.R., in *Prairie Farmer*.

EXPERIMENTAL FARM, NARROGIN.

REPORT FOR OCTOBER, 1905.

By F. L. Faulkner.

The past month has been a fair one for the crops and grass, and the former on this farm and in the vicinity have made wonderful growth latterly.

Generally speaking, however, the crops in our immediate vicinity are going to be lighter than last year, owing mainly to the excessive wet weather experienced in May.

The crops on this farm, although very short and light for hay, should give fair grain returns if we are fortunate enough to get another fair rain and good ripening weather during the coming month.

The following are some of the experiments conducted on the farm during the year, detailed returns of which will be published as soon as the crops are harvested:—

The "Manure Test" Plots.

The object of these series of plots is to endeavour to find out the most profitable dressing to apply to the wheat crop, and as it is the intention to make the experiment continuously on the same pieces of land, the effect of continuous manuring with the respective manures or mixtures of manures will be found out.

The land selected for conducting this series of experiments was of a light loamy character, and as even in quality as it was possible to get. Drilling was started on the 23rd and completed on the 25th of May, 1905, with the exception of plot No. 17, which was sown seven days later.

Each plot is two-fifths acre in extent, and was seeded with "Alpha" wheat at the rate of $1\frac{1}{4}$ bushels per acre.

No. of Plot.	Manure applied per acre.	Cost of Manure per acre.	Remarks.
1	No manure	*Nil*	Backward and thin
2	56lbs. 36/38% Super.	2/3	Much better than No. 1
3	112lbs. 36/38% Super.	4/6	Much better than No. 2
4	224lbs. 36/38% Super.	9/-	Started best of all, but seemed to suffer most from frosts. Thicker than No. 3, but yellow colour
5	112lbs. 36/38% Super. ... ... 56lbs. Sulph. Ammonia	4/6 8/6 } 13/-	Little or no better than No. 3
6	112lbs. 36/38% Super. ... ... 56lbs. Nitrate of Soda	4/6 7/6 } 12/-	Same as No. 5
7	112lbs. 36/38% Super. .. .. 56lbs. Nitrate of Soda (top dressed) ...	4/6 7/6 } 12/-	Best plot of the series. Promising several bushels above everything else
8	112lbs. 36/38% Super. ... ... 56lbs. Sulph. of Potash	4/6 8/- } 12/6	No better than No. 3
9	112lbs. 36/38% Super. ... ... 56lbs. Kainit (Chloride of Potash) ...	4/6 8/- } 12/6	No better than No. 3
10	112lbs. 36/38% Super. ... ... 56lbs. Sulph. Ammonia ... ... 56lbs. Sulph. of Potash.	4/6 8/6 } 21/- 8/-	Started very well, but is now little better than No. 3
11	No manure (top dressed with 112lbs. Super.)	4/6	Backward and thin
12	112lbs. Mineral Superphos., 36/38% ...	4/6	Strong and forward
13	112lbs. Bone-dust { 3·5% Nitrogen, 47·5% Phos. of Lime, ·13% Potash...	7/6	Not so forward as No. 12
14	112lbs. Phosphatic Guano	2/9	Practically same as No. 13
15	112lbs. Thomas's Phosphate	3/6	Better than 13 or 14, but not so good as No. 12
16	224lbs. Gypsum	8/-	Came away quickly and grew well, but not so well as those plots receiving phosphate of lime in some form
17	75lbs. Sulphate of Ammonia	12/-	Thin, backward, and poor
18	75lbs. Sulph. of Potash	12/-	Thin, backward, and poor
19	No manure	*Nil*	Thin, backward, and poor
20	112lbs. 36/38% Super.	4/6	Strong, well-grown, and forward

NOTE.—Plots No. 7 and 11 received the top-dressing of nitrate of soda and superphosphate respectively on the 15th of August and when the crop was from 8 to 10 inches high.

Although the above plots are not set ready for harvesting, many of the results can already be safely compared. The "no manure" plots, for example, are far behind those receiving a dressing of phosphate of lime in some form or another.

Also plots receiving potash or nitrogenous manures only are far behind those receiving phosphate of lime; in fact they appear in some instances almost worse than the "no manure plots."

In comparing plots 6 and 7, which have had exactly the same manure, only applied in a different manner, plot 7, which received the nitrate of soda

as a top dressing, is far ahead of its fellow plot. The cost of nitrate dressing however was 12s. per acre, and to make the manuring profitable an extra return of at least four bushels per acre will have to be harvested over and above the one cwt. of superphosphate plot.

In the test of quantities *re* plots 1 to 4, plot No. 3 is going to pay the best—directly—but it must be remembered that the extra cwt. used on plot 4 is not wasted and will materially improve the grass and future crops. The heavy dressing applied to plot 4 would, I think, have more than paid for itself had it not been for the excessive frosts experienced, which seemed to check the more luxuriant growth much worse than the shorter sturdier vegetation.

The Variety Test.

In this test the plots are half rood in extent and each variety has had identical treatment, being manured at the rate of 1½cwt. of superphosphate per acre and seeded with one bushel of seed. Drilling was done on June 12th and 14th. The soil is virgin, part of it being October fallow and the other part just cleared, ploughed, well harrowed and drilled. Each variety has a similar proportion of the fallow land.

Plot No. 1: *Alpha Wheat.*—Did well last season. A tall, very early variety. A good variety for late sowings.

Plot No. 2: *Australian Talavera.*—One of the best all-round wheats we have tried. Hardy, early, good for hay and grain.

Plot No. 3: *Jade.*—Did fairly well last season; midseason to early. Large-grained, good headed wheat.

Plot No. 4: *Sullivan's Early.*—A good yielder; early, but very bad to shell out, and a poor hay wheat.

Plot No. 5: *Medick.*—A good-stooling hay wheat; midseason.

Plot No. 6: *Baroota Wonder.*—Midseason, early; a good hay and grain wheat.

Plot No. 7: *Marshall's No. 3.*—Midseason wheat; gave the heaviest return on the farm (19¾ bushels on poor land) last season. Promises well, but sown rather late for the best returns this season.

Plot No. 8: *Fillbag.*—Midseason variety; the second best last season. A good stooler and fine-headed wheat.

Plot No. 8A: *Silver King.*—A very similar wheat to Marshall's No. 3, only better threshing and rather a better variety. Very rust-resistant and a good milling variety.

Plot No. 9: *Federation.*—Midseason; a good yielding, short-strawed, brown-chaffed wheat. Rather backward this season.

Plot No. 10: *White Lammas.*—Midseason wheat; makes nice, soft hay; is rather pale in colour and backward this season.

Plot No. 11: *Lucky Talavera.*—Promising well; stooled and grew very fast. Midseason.

Plot No. 12: *Tardent's Blue.*—Midseason to late. A short, sturdy-growing variety.

Plot No. 13: *Gallant's Hybrid.*—Late, and does not do very well under our conditions. It is a hard, flinty-grained wheat, little good for milling purposes.

Plot No. 14: *Plover.*—Midseason to early. Fairly promising.

Plot No. 15: *Toby's Luck.*—Promises well. Midseason, early.

Plot No. 16: *Crossbred No. 73.*—Very early, but small headed.

Plot No. 17: *Crossbred No. 100.*—Very early; tall, but poorly headed.

Plot No. 18: *Bobs.*—A good-stooling, sturdy-growing wheat, promising fairly well; but a better crop would have been obtained from earlier sowing. Said to be a good milling wheat.

Plot No. 19: *John Brown.*—Midseason, stooling variety; promises fairly well.

Plot No. 20: *Bluestem (Manitoba).*– A late-stooling variety; not much good for our conditions.

Plot No. 21: *Power's Fife.*— } Very late stooling, and not much good
Plot No. 22: *Whitney's Fife.*— } for these districts.

Plot No. 23: *Goldsmith.*—A good-headed midseason; early variety.

Plot No. 24: *Whitlock.*—A good hay wheat.

In addition to these varieties of wheats, the following have been tried in small varying-sized plots. (A large number of selected and unnamed varieties have also been tried):—

Paros.—A Greek variety; is doing fairly well.

Kutauka.—Said to be the best of the Macaroni wheats; promises a fair crop.

Medeah.—A hard flinty-grained wheat, of the Durum species; solid strawed, and a heavy hay wheat. Is doing fairly.

Polish Wheat (Triticum Polonicum).—A long flinty grain; not much use except for decorative purposes.

Champlair.—A good stooling midseason wheat with fine healthy-looking flag.

Manitoba Red.—A strong floured red wheat; proving rather late for our district, but may be a useful wheat if sown earlier.

Stienlee.—Early non-stooling variety.

Allora.—Midseason, fair stooling wheat. A fair yielder of very nice plump grain.

Oats.

Received practically the same treatment as the wheat, but sown at the rate of 1½ bushels per acre.

Early Ripe.—One of the earliest; a good hay oat, but the grain is rather long and thin.

Algerian Oat.—A good all-round variety; good for hay, and gives a good fairly plump brown grain; midseason.

White Siberian.—A good feed oat; midseason to late; rather backward, but a good thick crop.

Golden Fleece.—A nice feeding oat; midseason; promising a fair crop.

Calcutta.—Is not doing very well.

Trefoot.—A nice quality oat; is growing strong and stooling well.

Other crops on the farm, such as potatoes, peas, vetches, and grasses are still rather too backward to report on. The peas, however, are doing very well, and a good crop should result.

Feed has come on wonderfully during the month, and all stock are in good condition.

Seven cows are in milk and doing very well.

Shearing will be commenced in a few days. The sheep are all in splendid condition, and should cut well. The lambs this season are well grown and strong, a few of them that have had the advantage of a little rape-feeding are prime. Killing over 40lbs. There are May-June lambs. The Angora goats are still kidding, although the dropping is not yet complete. The clip this season averaged $3\frac{1}{2}$ to 4lbs., but much of the hair had dropped before the weather became settled enough to shear them.

The pigs are at present enjoying the run of a patch of swedes, this crop (although not an extremely heavy one—the land being very second rate) has already been of great service for feeding. Two small paddocks that were sown to peas and vetches are also ready fenced and waiting till the pigs require them.

A good deal of ploughing has been done during the month, the rape and catch crop being fed off and ploughed.

Hay and silage-making will be in progress in a week or two. Silage will be made from a piece of self-sown crop that has up to now been too wet and soft to bear a team. It is my intention as soon as it is mown to plough it up and sow it to maize and sorghum, as it is still moist enough.

STORED APPLES AT THE BUNBURY SHOW.

Mr. Despeissis, the Horticultural Expert of the Department of Agriculture, reports that amongst the fruit exhibits at the Bunbury Grand National Show, held on the 14th and the 15th of November, were a few cases of apples shown to demonstrate the keeping qualities of the kinds exhibited after long storage in cool chamber.

The exhibitors were invited by the Wellington A. and P. Society to select and pack the cases themselves and consign them to the Government Refrigerating Works, Perth, not later than the 1st of July.

There they were taken charge of by Mr. A. D. Cairns, the manager, and stored in a cool chamber, where a temperature of 35° F. was maintained throughout the storing period.

That the temperature was maintained with remarkable uniformity was evidenced by the Thermograph record scroll, which was also exhibited, and which shows a straight line of temperature with occasional oscillations of one degree during the time the fruit was in the chamber.

During that period the air in the chamber was kept free of moisture by means of absorbents, and the heavier air, laden with carbonic acid, was occasionally swept out so as to remove all causes which favour decay.

Three days before the show, the cases were removed from the cold chamber and placed in another one where the temperature registered 45° to 50°. The next day again they were further gradually warmed up by exposure in a temperature of 55° to 60° F., and they were then railed to Bunbury where the cases were opened on the 14th of November, four and a-half months after having entered the cold chamber.

The fruit opened in very good order, but from an educational point of view it is to be regretted that exhibitors should not have used the accepted apple export case, used by shippers of Tasmanian and Australian apples, instead of the ordinary bushel case which is generally used in our local market.

The dimensions of the export cases referred to are 20in. x 15in. x 10in., whereas those of the cases used are $28\frac{1}{4}$in. x $14\frac{1}{2}$in. x $7\frac{1}{2}$in. They both hold slightly more than an imperial bushel, which measures 2,218 cubic inches. Of the export case, 23 go to the ton, ship measurement, whereas of the case used 22 cases go to the ton. However, as all the cases were alike, the comparison between the several kinds of fruit was made easier, and a few notes concerning each case may be of interest to the exhibitors themselves, as well as to others, who, before very many years, will have to look to the export market as a means of absorbing the yearly-increasing output of their orchards.

Mr. J. Hawter, the judge at the competitions, accompanied by Mr. Despeissis, made, respecting each exhibit, the following remarks:—

Case No. 1 (592 of the catalogue), the winner of the prize—Rokewood: Layers of two rows in each compartment, each of these half rows containing six apples; fruit picked before it was fully ripe; very uniformly graded; firmly packed; soft tissue paper, oiled on one side only, the glazed face outside used; the apples neatly wrapped, the eye in the centre of the paper and the corners and edges twisted round the fruit stalk; no signs of decay and no shrinkage; a very well packed case.

Case No. 2 (586 of catalogue).—Rokewood: Fruit a little larger than No. 1; wrapped in stiffer paper, glazed on each face; rather too much paper used; fruit shrunk a little, otherwise in a good state of preservation.

Case No. 3 (587 of catalogue).—Rome Beauty: A very good sample, rather on the large side for long keeping; four fruit in each half row, wrapped in soft white tissue paper which is better than the sample shown in No. 2, but not so suitable as that used in No. 1; kept well.

Case No. 4 (588 of catalogue).—Nickajack: Not well graded; four in some half rows and three in others; wrapped in white tissue paper; shrunk a little; kept well.

Case No. 5 (589 of catalogue).—Nickajack: Too ripe when packed; sample too large for long keeping and not graded; fruit not wrapped but laid in rows in little paper cells arranged after the fashion of an egg box, with a sheet of paper between each layer, and thick folds of newspaper at one end to wedge the fruit together; deficient packing; a large proportion of the fruit spoilt by ripe rot.

Case No. 6 (590 of catalogue).—Rokewood: Wrapped in stiff buff-coloured paper and too much of it; five apples in each half row; loosely packed; kept well.

Case No. 7 (591 of catalogue).—Rome Beauty: Much too large for long keeping, most of the apples having cracked in the cool chamber and showing marks of bruises; set in half-rows of three; not wrapped, but with layers of paper between and newspaper pads in the corners; a badly packed case; wet, and showing a good deal of waste.

Case No. 8 (593 of catalogue).—Yates: Wrapped in stiffish white paper in half-rows of five each; fruit right size, and kept splendidly; excellent flavour; contents shrunk a little.

Case No. 9 (594 of catalogue).—Nickajack: Fruit much too large for long keeping, also somewhat too ripe; four fruit in each half-row; roughly wrapped in newspaper; slack; showing a large proportion of waste and decay through ripe rot.

POISON PLANTS IN THE NORTH-WEST.

Some few weeks since the death of large numbers of cattle was reported from the Ashburton district, and the Government Botanist (Dr. Morrison) was told off by the Director of Agriculture to make an investigation, as it was supposed the fatalities were due to the presence of unknown poison plants. The botanist has now returned, and reports having visited the Minderoo, Globe Hill, Uaro, and Nanutarra Stations. While travelling between Globe Hill and Uaro, Dr. Morrison found a plant having the aspect of a *Tephrosia*, a genus of leguminous plants known to be poisonous, and on arrival at Uaro it was shown to Mr. McCarthy, who at once recognised it as the plant that had been suspected of poisoning the cattle. The cattle were said to have eaten the plant at sunset, and next morning symptoms of illness were observed. Some were dead at sunrise, and others died on the track. Dr. Morrison adds: "Examination of the suspected plant shows it to be *Tephrosia rosea*. It is not found outside Australia, but is recorded from many parts of Queensland, and the driver of the cattle recognised it as one he had seen in Kimberley, where it was known to be poisonous. It figures in Bailey and Gordon's 'Book on Plants,' and is reputed to be poisonous and injurious to stock. From the close botanical relationship between it and *T. purpurea*, which is well-known in Australia and other countries as a fish poison, we are justified in suspecting it of possessing similar injurious qualities. *Tephrosia rosea* is plentiful along the Ashburton River, from the coast upward, and I secured a quantity for chemical analysis. Although there are in the North-West none of the virulent *gastrolobiums* or *oxylobiums*, so prevalent in the South-Western division, still there are others belonging to the same tribe of the *leguminosae*, as *Tephrosia rosea*, and some euphorbiaceous plants, that are likely to be proved dangerous to stock. The visit was not made at the best time for collecting botanical specimens; but nevertheless I was successful in adding many interesting specimens to the Departmental Herbarium."

DISTRICT NOTES.

THE PINGELLY DISTRICT.

The inspector of lands at Pingelly, in his quarterly report, refers to the great advance that has lately been made in this portion of the Great Southern district.

The Pingelly district, which has hitherto claimed little attention from the general public—owing, perhaps, to the able representation of the more fortunate sister districts of the G.S.R.—is now coming rapidly to the fore with a valid and permanent resource beyond eclipse. The township itself is attracting business men. The Commercial Banking Company have opened in temporary premises; but their building now in the course of erection, with that of the W.A. Banking Company newly opened, signifies the change from the makeshift to the durable. Additions are being made to the present hotel, and several shops are under way, while residences of a solid character are rising over the townsite.

At Popanying a license for an hotel to cost £1,500, and whose erection is straightway intended, is granted to Mr. Parker, a new settler. A public school was recently opened at the siding, and I am informed that two stores are shortly to be erected. Town lots have realised £55 from the auctioneer's hammer, while there is an urgency for further subdivision of town, and especially garden and suburban, lots. I hear many inquiries for such from people desirous of exploiting horticulture, for which the Hotham Valley readily lends itself, proof being manifest by the various farmers there established. Popanying is recognised to be one of the most favourably situated townships on the G.S.R. In the Hotham River it possesses a permanent water supply, while with Pingelly it is the natural outlet of the Wickepin area. A glance at the map will show Narrogin to be about 13 miles in the rear to the metropolis from the Wickepin area; Cuballing 12 miles, and Popanying and Pingelly eight miles and 12 miles, respectively, in the direct line of communication. This observation should dispel any doubt as to the natural centre of delivery of produce from the richest agricultural area of the G.S.R.

The physical features of the Pingelly district admirably lend themselves to agriculture. The country being mostly undulating, nearly all holdings have a sufficient natural drainage. Notwithstanding the exceptionally heavy rains, the crops are looking splendid, and only few show the effect of superabundant rainfall. The roads of the district are in a bad state. Many culverts have been swept away by the recent floods, leaving the roads in many places impassable. The flood waters in the Hotham River have rendered it unfordable for some time past.

Of the many new and enterprising settlers, I will touch on several who have come within my immediate observation. Mr. Langsford, an ex-Victorian, arrived here in March, and has succeeded in clearing and cropping 125 acres, while an additional 100 acres are ready for fallowing. His horses and plant imported are of a first-class order. Mr. Lange brought over an excellent plant, and taking possession of a virgin holding in the early part of the year, has upwards of 100 acres under crop. Mr. Lange, sen., father of the above,

W. Lang's Homestead, 17 miles East of Narrogin. On the land three years; 140 acres cleared; one acre of Orchard.

at his son's representation, made a visit to the State, and was so pleased with the prospects that he purchased a large holding of almost virgin country in the near vicinity.

Mr. Oates also brought along horses, cows, and farming machinery. Purchasing an estate of some 600 acres, he has erected a substantial dwelling, and is now engaged clearing 200 acres. On the way hither Mr. Oates made a halt at Katanning, and placed a large area under crop on the half system, where he is experimenting with varieties of wheat from the Eastern States, sowing four bags Marshall's, four Sydney Purple, two Smart's Pioneer, one Leake's Improved, one bearded wheat. The result of this experiment will be keenly watched, and in the hands of such a practical man as Mr. Oates the trial will be no slipshod one. Mr. Watson, of Yornan, has erected a splendid residence of granite, costing £100. The stone, of which there is an unlimited supply, is equal to Melbourne bluestone. Mr. Watson's holding comprises some 3,000 acres, on which he has effected extensive all-round improvements. His idea is to follow mixed farming. A small paddock of lucerne planted this year will, Mr. Watson anticipates, do well, as the Hotham Valley is adapted for its growth.

With regard to the importation of stock, Mr. F. T. Wake imported a batch comprising five horses, 20 cattle, and 155 sheep, all of which were landed from South Australia without a single casualty. The stock is of a first-class quality. Two thoroughbred draught mares, bought at the Parade, Adelaide, cost Mr. Wake 65 guineas per head. The cattle were selected from a good dairy herd, and are chiefly crosses between the Alderney and Ayrshire and Alderney and Shorthorn. With the pure-bred Shorthorn bull included in the importation, it forms a very creditable herd to embark in dairying pursuits. The sheep include four stud Shropshire rams and 151 maiden ewes (comebacks). These latter were purchased from Potallick Station at 27s. 6d. per head.

The trend of settlement is gradually extending eastward, and tracts hitherto regarded as valueless are now claiming the selector's attention. That the regions eastward are no barren wastes, but capable of development, may be gauged from the fact that Messrs. Sewell and Fairhead, gentlemen reared in the district, have within the last few months taken up holdings of 2,000 and 800 acres respectively 30 miles due east, whilst Messrs. Giles and Vaughan and others have also selected extensive holdings in the same locality. Messrs. Bartlett and Finlay, venturing beyond the rabbit-proof fence, have secured holdings between sixty and seventy miles due east.

NANGEENAN.

The Experimental Farm and the Special Settlement.

Mr. R. Cecil Clifton, the Under Secretary for Lands, has written the following report on the Nangeenan experimental farm and special settlement, as the result of a recent visit of inspection :—

Nangeenan being situated about 95 miles east of Northam—practically beyond the confines of what has in the past been considered the cultivable belt of country east of the Avon Valley—makes it of more than ordinary interest as an experiment and object-lesson, and, judging by this the first year's crops, the Department has no reason to be dissatisfied with the

experiment; in fact, bearing in mind that the rainfall for the year has been below the average, and that the land was ploughed and sown without being fallowed, the results are distinctly encouraging.

The farm was first started in June, 1904, but it was not till the January following that clearing operations commenced; and between then and up to the middle of April 114 acres were cleared, ploughed, and sown with wheat, the greater part of it of necessity being ploughed and sown almost immediately after the timber was burnt off.

Several different varieties of wheat were put in, and some of these have done much better than others, but all show a marked increase in growth and vigour where the land has been cleared and ploughed even a couple of months before sowing. One hundred and five pounds of superphosphate to the acre was used as a fertiliser, but here and there throughout the crop a small strip has been left without the fertiliser for comparative purposes; the difference between the crop of these strips and the fertilised land adjoining—otherwise dealt with in exactly the same manner—is, as might be expected, very marked.

In this country of sparse rainfall very early sowing appears to be a matter of first importance, in order that the crop may have the advantage of all the rain that falls. This is shown very unmistakably in some of the contractors' crops adjacent to the farm, which were sown on similar land at various dates after the completion of the sowing on the Government farm, the crops varying according to the date of sowing from the Government crop, which is estimated will yield over one and a half tons per acre, to one or two of the contractors' crops sown in the middle of June, that will be hardly worth cutting.

The crops are now ready to cut for hay, and the reapers and binders have commenced work, but it is proposed to save the greater portion of the Government crop for seed. Mr. Robinson estimates that the yield will be over 20 bushels to the acre for some of it. Around the homestead a piece of land has been enclosed for a garden and small orchard, a few dozen trees in which are looking well; and Mr. Robinson has a small patch of vegetables, which are all that could be desired, but these have been watered.

The Special Settlement.

In January, 1904, Mr. Hopkins decided to start a special settlement, somewhat on the lines of the Hamel Settlement, and the vacant lots in the Bainding agricultural area, which practically surround the experimental farm, were set apart for this purpose, and allotted to selectors under clearing contracts, the contractor agreeing to clear a certain amount of land at a fixed price, to be paid monthly by the department, on the work being passed by the manager. The term of the contract is for two years, and during that period the contractors have the right to cultivate the land and make what they can out of their crops, and at the end of the term they have the first right to select their blocks, either on a long lease or under conditional purchase, at a price which covers the cost of clearing.

In about April last the contractors, many of whom had a good patch of clearing done, approached the Government with a view to having their land ploughed and sown by the department, the contractors agreeing to repay the cost out of the crop. This was eventually agreed to, and plots varying in area from six to 92 acres—totalling about 600 acres between 18 contractors—were put in. It must, however, be distinctly understood that this was no part of the original scheme which the department had in view, and, as pre-

vious provision has not been made for it, it was hardly possible to get these crops in as early as was desirable. This alone is responsible for these crops not being equal to those on the experimental farms referred to previously. The contractors, of whom I saw a good number, recognise this, and, though disappointed that their crops are not better, admit that it is not the fault of the land, but simply owing to the accident of the late sowing. They are generally satisfied with their prospects, and are continuing their clearing, and in some cases endeavouring to get additional land with a view to having a larger extent under crop next year. Several of the contractors have, either singly or jointly, purchased reapers and binders, and are working for each other, so that, with the exception of about three of the smallest plots, the department will not have to harvest these crops for them.

The country is timbered with salmon gum and gimlet wood, and the remarkably beneficial effect of ringbarking or clearing this forest land, which in its natural state is almost bare of grass, is, of course, well known to you; but it was particularly brought home to me in one case where a contractor, after having cleared portion of his block, abandoned it in November last, since when the natural grasses have been allowed to grow unchecked. There were three different kinds of grasses pointed out to me by Mr. Robinson on this block, all good fodder grasses, samples of which I submit for your inspection, and some of which you will see is over 4ft. high.

Mr. Growden has a farm adjoining the settlement, and this year has 300 acres of wheat in, which he estimates will yield two tons of hay to the acre; and last year his crop was even better. He informed me in conversation that he had been there eight years, and had only had one year's failure, and that was the only year in the eight which was less favourable than the present one.

Although farming in these dry areas has its drawbacks, it appears fairly evident that with fallowed land, the use of a fair amount of fertiliser, and early sowing, good crops may be reasonably expected in the generality of seasons. A farmer in this part has the advantage of being so much nearer the market on the Eastern Goldfields, and the season being earlier than in the more western portions of the State, he gets a better price for his produce, and, notwithstanding the possibility of an occasional failure owing to insufficient rainfall (as Mr. Growden states occurred about four years ago), the experiment seems well worth continuing.

One point that occurs to me in connection with farming in this extremely dry, hot climate is the necessity for leaving a fair proportion of timber for the purpose of shade for stock, as well as for future use for farm and domestic purposes. In any part of the State the clearing of hundreds of acres at a stretch without leaving a single tree, as is often the case, seems to me a grievous mistake, and people not infrequently recognise it when too late; but it will be nothing short of cruelty to animals to do the same in this part of the country. Moreover, the gimlet wood, with its remarkably straight and strong stems, though not much of a shade tree, can be so readily utilised for construction of buildings, fences, etc. (though on account of white ants it must be kept out of the ground) that a few good clumps of this timber on a farm will be a valuable asset, while a few well-developed salmon gums here and there will afford shade for stock, and add a pleasing feature to what will otherwise be a very monotonous landscape.

I cannot conclude my remarks without a word of praise to the manager (Mr. Robinson). Criticism of his farming may be left to the experts, but it

needs no expert to appreciate the general air of order, method, and neatness that is everywhere apparent on the farm; and I know from experience that in conducting the business he is as careful of Government funds as if they were his own. With regard to the management of the special settlement, he is carrying out a somewhat difficult and thankless task to the satisfaction of the department, while his straightforward dealing commands the general respect of the contractors.

QUARTERLY REPORT FROM INSPECTOR OF LANDS, AVON DISTRICT.

By Inspector H. St. Barbe More.

I beg to report for the quarter that ended on the 31st August, that during this term, the boundaries of my district were readjusted. They now take in about 1,300,000 acres of land, extending approximately 53 miles east and 15 west from the Great Southern Railway, with the limit on the north lying about midway between York and Northam, and on the south running east and west through Mt. Kokeby.

Development of holdings and growth of settlement both continue in a state of healthy and steady advance. The rich vacant lands around Cubbine, Dangin, Caroling, and County Peak are being daily marked on the working plans in the Beverley Crown Lands Office with fresh selections. The available spaces on the western side of the Great Southern line show somewhat less pencillings. There is something to be learnt about the country between the Dale River and the Goldfields' watershed boundary, and, in spite of its apparent relative unpopularity, I commend cancelled P.P.R. $\frac{8}{246}$ and thereabouts, plan $\frac{342}{80}$, to prospective sheep-breeders among new-comers. Red, rocky elevations are a feature of this neighbourhood; its rainfall exceeds that of York and Beverley. It looks all over as if it would lay out well to sown grasses and respond to a system of successional fodder crops. It would suit a Merino-Leicester or Romney-Down cross perfectly, and there is no doubt that its wooded uplands and level expanses are destined to become important breeding and fattening runs. In this connection one cannot help thinking with appreciation of what has been done by Mr. W. T. Craig, of York. This gentleman was born in York, and has been farming in the locality for some 18 years. He should, therefore, have been well aware of the risks he was rendering himself liable to when he took up a large area of this poison-infested whitegum country. Yet Mr. Craig has converted this holding into one of the finest sheep pastures in the district. Spring water and fattening grasses have incredibly justified the trifling outlay on ringbarking, and the only memento of the poison is the levity with which Mr. Craig treats any allusion to it.

A farm held conjointly by two Victorians, who came over after hearing Mr. Wilbur's lectures, was one of the holdings I visited during the period under notice. These new settlers have scarcely had time to get to work yet, but they are auspiciously commencing with evidently a lasting enthusiasm born of the contrast between the inconstant Mallee and our reliable seasons. A dairy farmer from New South Wales is another who has lately selected in my district. I came upon him the other day, complacently strolling over a beautiful and fertile tract covered with York gums and jams, and traversed by a strong watercourse. This, he informed me, was the spot he had just

chosen to develop and equip as a well-appointed dairy farm, of which cheeses were to be the staple output. I need not here repeat the remarks I made under the heading of "The apparent trend of farming in the district" in my annual report for 1904.

Messrs. Prowse Bros., of Mount Kokeby, have an experimental field of 10 acres sown in plots with prairie grass, perennial rye, cocksfoot, rib grass, white clover, lucerne, paspalum, and some seeds imported from the Tumut district of New South Wales. The latter appears to be a sort of clover, and forms a thick sole when up two or three inches. Mr. Albert Prowse does not know the name of this variety, but declares that it spreads and thrives well even in the driest parts of New South Wales. I shall, with the kind permission of these progressive young farmers, watch their interesting and valuable trial and report to you from time to time about it.

The historic old York Agricultural Society has recently adopted a new and very comprehensive code of rules which, it should be mentioned, is a digest of those of the senior Victorian and New South Wales societies, with some slight additions and modifications. The avowed objects of the society now are "to promote the development of the agricultural, pastoral, horticultural, and industrial resources of the district."

(*a.*) By holding exhibitions at such places and times as the committee shall appoint, and by offering and awarding prizes and premiums at all such exhibitions, if deemed desirable.

(*b.*) By holding meetings at such places and times as the committee shall appoint, at which meetings papers may be read and discussed, and other papers particularly affecting the industries represented in the society debates.

(*c.*) By collecting such information from agricultural publications, scientific and other works, as may be useful in promoting the objects of the society.

(*d.*) By corresponding with agricultural and other kindred societies at home and abroad, and collecting from such correspondence all information which, in the opinion of the committee, may lead to practical benefit in the cultivation of the soil and breeding of stock, as well as the prosecution of other important industries.

(*e.*) By encouraging the attention of men of science to the discovery of better methods of cultivation, to the improvement of agricultural implements and machinery, the construction of farm buildings, the application of chemistry to the general purposes of agriculture, the destruction of insects injurious to vegetable life, and the eradication or utilisation of weeds.

(*f.*) By promoting the discovery and introduction of new varieties of cereals, vegetables, and grasses suitable to the climate, and capable of being cultivated with profit.

(*g.*) By investigating the nature of diseases in animals or plants, and taking measures for the publication, at such times and periods as the committee may appoint, of the information thus collected, together with all approved original essays sent in, lectures delivered, or papers read to the society, besides making provisions for the establishment of library and reading room for the use of members.

(*h.*) By remunerating any person, if thought fit, who shall ascertain by experiment how such information may lead to useful results in practice for any loss incurred by such experiments.

(*i.*) By encouraging by every possible means the judging of live stock by points.

I am sure that it will be exceedingly gratifying to the Department to hear of the above movement, and to gather therefrom that the York Agricultural Society now proposes to "pull its weight." It should be the function of such bodies to step in where departmental agencies cannot do everything; to see that settlers, who, in common with all mankind, are, sponge-like, fundamentally held together by the spicules of expediency, are also kept encompassed by their proper softening and fostering element in which the great work they are doing will be directed along pleasant, business-like, scientific, and profitable lines.

The School Boards are attending to the educational wants of the district in a creditable manner. A school has been opened at Gilgering; new ones have just been erected on the West Dale and at Mount Hardey, and others are under consideration.

The season is very backward; late crops are not showing satisfactory vigour of growth or stooling out well. On the whole, however, the prospects of a good harvest are distinctly hopeful.

A GENERIC TERM FOR AUSTRALIAN WINE.

During the Melbourne Royal Agricultural Show week we have had the pleasure, says the *Australian Vigneron,* of seeing and conversing with some of the leading wine-growers of Victoria. In course of conversation most of them said that they were very strongly in favour of a generic term for so-called Australian burgundies and clarets, which they, and experts, acknowledge possess a distinctive flavour imparted by the soil and climate in which they are produced, and they agree with us in thinking that these wines, purely an Australian product as regards the flavour, have too long been kept in the leading-strings of names belonging to wines from which they differ considerably. It is well known that no one would for a moment dream of trying to place cigars grown from Havanna seed in the various States of the Commonwealth upon the market as Havanna ones? Why? Simply because the difference in taste can be easily detected, and so with our so-called burgundies and clarets—they have a distinct taste compared with their French compeers, and are worthy of a distinctive title, but with this difference, whilst tobacco grown from Havanna seed in the States of the Commonwealth, or, for the matter of that, anywhere else outside of Cuba, loses the peculiar characteristic imparted only by the Cuban soil, and so, in the opinion of experts and others, deteriorates our so-called burgundies and clarets produced from imported vines, gain from the soil and climate in which they are produced a characteristic which makes them easily distinguishable from their European progenitors, and renders them well qualified to hold their

own against any wines of their class produced elsewhere. Even now this difference or characteristic, without any special effort on the part of our wine-growers, is every year becoming more appreciated by experts and connoisseurs in England.

Such being generally admitted by the bulk of the wine-growers, we can only hope that for their own sake, and for the future of this great industry, the day is not far distant when concerted action will be taken by the growers to create some distinctive title which their wine thoroughly deserves. United upon this matter, they would form a solid phalanx to the rest of the world, and easily secure for their Australian wines a world-wide recognition of and approval for the title they thought fit to confer upon them. This accomplished, the public in Europe would soon learn to ask for the wine shipped from Australia under a distinctive name, and appreciate as fully the characteristic of our wine as they do now that of other countries, thereby creating a demand which would be practically unlimited. So, to our growers we would say: Shake off this lethargy which allows you, year by year, to go on selling your peculiarly Australian product as burgundies or clarets! Insist and agree among yourselves upon some distinctive title, such as "Aust," and the time will surely come when connoisseurs and others in the old world will value and appreciate as highly Australian wine under a distinctive title, as they do now French or other European.

IMPROVEMENT OF FARM PLANTS.

By H. J. Colbourn.

Leguminous and Forage Crops.

The cabbage, cauliflower, and allied varieties of this section of farm and garden plants have for many years received much attention from growers, and great improvements have been effected in regard to size, quality, and early production. With regard to this family of plants, it is a matter of considerable importance how the seed is produced; and this is of particular moment in the case of the cauliflower, which often fails to produce a good compact head, because the seed from which it is raised has been grown from the side shoots, which come on after the head has been cut for market. Plants raised from seed thus produced will run mostly to stem and leaf, or at best, yield only small heads although the parent stock may have been a first-class variety. In order to avoid this, the best possible heads should be selected and allowed to run to seed, isolated, of course, from all possible contamination by pollen from inferior sources. When the heads are very compact, it is a good plan to gash them with a knife nearly to the stump, to help the flowers to start. The latter should be restricted to four stems, and from these all inferior pods should be cut off as the seed develops, by which means only good seed capable of producing first-class cauliflowers will be obtained. As this crop, which is not so much grown by

the agriculturists as it might be, is nevertheless a valuable one, especially near large towns, it will usually pay to devote this extra attention to it when its cultivation is undertaken.

Among leguminous crops the pea presents many varieties, the differences chiefly hinging upon habit of growth, size, and quality of seed, and early maturity. It is evident that the high climbing kinds appropriate for garden cultivation cannot be profitably grown in the field, on account of the expense of providing and fixing stakes for the plants to climb up; hence, those of a dwarf habit have been brought into use to suit the requirements of field husbandry. The question of maturing early assumes greater importance in the case of peas to be picked green. Here again much has been done by the method of selection, although it may be stated that manuring has often much to do in connection with early development; superphosphate having the power of pushing leguminous crops forward, especially peas.

Crimson clover, which is an excellent fodder for early spring use, could, when first brought into cultivation, only be depended upon for about a fortnight; whereas, at the present time the improved varieties of this plant yield forage for five or six weeks.

A valuable cross, the origination of which does not appear, is that between Red and Zigzag clover, from which has resulted Cow Grass clover, frequently confounded with common Red clover, but distinguished from it by several botanical characteristics, but from an economical point of view, by its perennial habit and by its coming to maturity between the first and second cutting of Red clover, a point of great importance where it is desired to keep up a succession of forage supplies.

With regard to the improvement of forage grasses, the following remarks, by Mr. Evershed, are of interest. He remarks: "Improved forms of forage plants or roots are far easier to produce than improved seed-bearing plants, like cereals, and the Rye grasses offer a variety of forms capable of advantageous modification. In the trial grounds at Reading, there are numerous plots of Rye grass, good and bad in character, as well as examples of the same variety of Rye grass, differing in quality in consequence of the seed having been produced in different districts. The common annual and the perennial Rye grass differ greatly in luxuriance of growth, the best sort of perennial Rye grass being exceedingly productive and worthy of its position as a grass that forms one-third of the bulk of some of our most productive pastures, while the annual variety is as unproductive as it is unpromising in appearance. One of these grasses in the middle of June looked brown and poor of produce; while the other was green, and growing like a plant which must needs produce a bulky crop. Among all the adulterations by which unwary farmers have been defrauded, none are more readily effected, none are more frequent, than those by which unscrupulous traders obtain undue profit in the sale of Rye grass which is not perennial, though it is represented as being so. The improvement of this particular crop urgently requires that the seed should be tested, that it should weigh from 20lbs. to 28lbs. per bushel, that cheap seed should be avoided, or sown side by side with other seed supplied by seedsmen of repute. The tendency of Italian Rye grass to produce seed-stalks instead of leaves, a characteristic fault which heavy and early stocking partially removes, has long represented itself to plant improvers as one which, perhaps, might be removed. A selector having succeeded in producing what is called a giant evergreen Italian Rye

COONDLE.

B. PEMBER'S FARM. Ancient Bark House; Thatch Roof.

grass, remarkable for its early growth and spreading leaves, the eminent firm who obtained the stock have been able to add to this most useful class of forage plants a decided improvement. A large farmer in the fens took me over his field of this new kind of Italian Rye grass. The whole of it had been cut for seed, and the shocks were still standing in the field waiting for fine weather, while a thick aftermath of spreading leaves already covered the surface. It is said that the growth of lucerne is extending, and that that plant was always grown in the fens; but my friend, who is experienced and by no means over-sanguine, believes that the new Italian Rye grass, with the only fault of that famous forage plant removed, will drive it from the field."—*Agricultural Gazette.*

THE DROPPING OF FRUIT.

Blooming time, the prelude to fruiting time, is now at hand, says the Australian *Journal of Horticulture.* About it clusters two all-important events for the fruit-grower: the setting and the dropping of fruits. Seemingly the more we cultivate and develop fruit-bearing plants the more we must consider these two events. The blossoms on wild species of our fruits nearly all set, but under cultivation but a small percentage of the many, many blossoms in our orchards form fruits. Nor is the reason far to find. The chief end of wild plants is reproduction—to produce seeds—but the energies of cultivated plants are diverted to other channels: the production of the juicy flesh.

Before the fruitgrower can understand well the life events that cluster about sex, he must distinguish cleary between two terms, pollination and fertilisation, terms supposed by many to have practically the same meaning. Pollination is the dusting of the stigma, the female organ of a flower, with pollen, the male element. Fertilisation is the process by which the male element is combined with the ovule, or female element. Fertilisation can take place only after pollination; but a flower may, of course, be pollinated and yet fertilisation not take place, a fact always to be remembered.

Now fertilisation causes fruits to set and to develop. Thus, through the formation of young fruits we may detect within a few days after pollination whether fertilisation has taken place. But a young fruit tree when first formed has but a slight hold upon life. Unfavourable influences, no matter how slight, may cause it to lose its hold, and so perish. Fertilisation gives the tiny truit new life, and strengthens its hold upon the parent plant through the nourishment drawn to supply the embryo which has been formed in the seeds by the process. Thus fertilisation usually, not always, determines whether a fruit is to live or to die. At this season of the year, shortly after blooming time, we have the early "drop" of fruit, resulting for the most part from a lack of fertilisation.

But fertilisation does not insure the complete development of fruit. Even after perfect fertilisation, so far as it can be determined, much fruit drops in every orchard, and without regard as to whether the trees bear light or heavy loads.

Weather conditions have much to do with the dropping of fruit. Prolonged cold snaps the vitality of young fruits and causes many of them of the more tender varieties to perish and let go their hold upon the trees. A scarcely less prolific cause of dropping is rain, whether a dashing shower or a prolonged drizzle at a low temperature. Even extremely moist atmospheric conditions without a fall of rain weaken the chance of full development of fruits if such conditions prevail soon after fruit formation. So, too, a lack of light causes fruit to drop, and thus we may in part explain the greater number of fruits at the tops of trees in well pruned, in open-centred trees and in orchards not thickly planted. For the most part the fruitgrower can regulate light, while he can do little with the other factors mentioned as causing dropping.

The early drop, especially of the peach, is a phenomenon of much moment to the fruitgrower. It may be explained as follows:—When fruits reach a certain size the food stored in the tree the previous year is exhausted. Now, if the leaves of such trees are not fully expanded, and if they are not able to furnish a new supply of food, the young fruits drop. The early drop is especially liable to take place if there be one or more of the unfavourable conditions mentioned previously.

There is also in some fruits a tendency to drop in late summer, when the fruits have nearly attained full size and the seeds are making great demands for food. The trees become exhausted and cast a part of their load. If at this time there be a drought, as is so often the case, fruit, not infrequently, drops in considerable quantities. To some extent the early drop and late summer drop can be influenced by the grower by supplying the best possible food and moisture conditions in the orchard.

This brings us to the question of food, or lack of food, as a distinct cause of the dropping of the orchard crops. Not only does the quantity of fertilisers in a soil influence the dropping of fruit, but the kind seems to have a decided effect. Thus, it is claimed, with a show of truth, that trees on soils deficient in potash or lime are prone to lose a part of their load. It seems worth while, too, with trees which habitually drop their crop, to try to direct the food to the fruit-bearing branches by pruning out surplus wood, cutting out water sprouts, and by stimulating the growth of fruit buds the previous season. All factors which are conducive to the best nutrition of the tree influence its capacity to retain the crop.

Lastly, it may be of distinct advantage for a tree to drop a part of its load if it has more fruit than it can bring to the best maturity. If it does not do so naturally, the fruitgrower should take the matter in hand and thin the crop.

WHEAT AND OAT CROP, 1905-6.

Estimated Hay and Grain Areas.

Magisterial and Police Districts.	Estimated Area laid down, season 1905-1906.					
	Wheat.			Oats.		
	Total Area.	For Grain.	For Hay.	Total Area.	For Grain.	For Hay.
	acres.	acres.	acres.	acres.	acres.	acres.
South-Western Portion.						
Northampton—						
Northampton	5,283	2,931	2,352	791	343	448
Victoria—						
Geraldton	3,665	1,492	2,173	1,065	198	867
Greenough	10,360½	5,391	4,969½	917	324	593
Dongara	2,013	1,328	685	88	75	13
Mullewa	88	88	...	20	...	20
Minginew	1,192	905	287	100	36	64
Total, Victoria	17,318½	9,204	8,114½	2,190	633	1,557
Swan—						
Guildford	517½	92½	425	725	34	691
Midland Junction	549	151	398	965	91	874
Mundaring	163	39	124	105	16	89
Gingin	2,131	1,590	541	1,770	336	1,434
Moora	5,150	3,374	1,776	1,189	619	570
Total, Swan	8,510½	5,246½	3,264	4,754	1,096	3,658
Northam—						
Northam	50,847	27,359	23,488	3,270	2,078	1,192
Newcastle...	30,887	22,532	8,355	3,259	2,399	860
Total, Northam	81,734	49,891	31,843	6,529	4,477	2,052
York—						
York	34,521	24,725	9,796	2,132	1,683	449
Beverley	25,436	19,621	5,815	1,519	1,167	352
Pingelly	14,890	11,952	2,938	859	562	297
Total, York	74,847	56,298	18,549	5,410	3,412	1,098

ESTIMATED HAY AND GRAIN AREAS—*continued.*

Magisterial and Police Districts.	Area actually laid down, season 1904-1905.					
	Wheat.			Oats.		
	Total Area.	For Grain.	For Hay.	Total Area.	For Grain.	For Hay.
	acres.	acres.	acres.	acres.	acres.	acres.
SOUTH-WESTERN PORTION.						
Northampton—						
Northampton	4,201	2,183	2,018	501	180	321
Victoria—						
Geraldton	3,634	1,300	2,334	682	104	578
Greenough	8,799	5,004	3,795	814	158	656
Dongara	5,714	3,967	1,747	418	315	103
Mullewa	20	...	20	40	...	40
Minginew	1,197	928	269	134	73	61
Total, Victoria	19,364	11,199	8,165	2,088	650	1,438
Swan—						
Guildford Municipality	12	...	...	1	...	1
Guildford	302	54	248	995	27	968
Midland Junction	538	252	286	1,167	101	1,066
Mundaring	310	147	163	139	3	136
Gingin	2,914	2,069	845	2,081	506	1,575
Moora	5,348	3,035	2,313	691	368	323
North Perth and Bayswater (part of)	8	8	...	...	...	...
Total, Swan	9,432	5,565	3,867	5,074	1,005	4,069
Northam—						
Northam	52,657	29,438	23,219	2,315	1,925	390
Newcastle	28,545	22,028	6,517	2,807	1,774	1,033
Total, Northam	81,202	51,466	29,736	5,122	3,699	1,423
York—						
York	33,455	24,024	9,431	1,467	1,194	273
Beverley	21,744	16,997	4,747	769	676	93
Pingelly	11,867	9,685	2,182	696	383	313
Total, York	67,066	50,706	16,360	2,932	2,253	679

ESTIMATED HAY AND GRAIN AREAS—*continued.*

Magisterial and Police Districts.	Increase or Decrease for present season (1905-1906).					
	Wheat.			Oats.		
	Total Area.	For Grain.	For Hay.	Total Area.	For Grain.	For Hay.
	acres.	acres.	acres.	acres.	acres.	acres.
SOUTH-WESTERN PORTION.						
Northampton—						
Northampton	1,082	748	334	290	163	127
Victoria—						
Geraldton	31	192	*161	383	94	289
Greenough	1,561½	387	1,174½	103	166	*63
Dongara	*3,701	*2,639	*1,062	*330	*240	*90
Mullewa	68	88	*20	*20	...	*20
Minginew	*5	*23	18	*34	*37	3
Total, Victoria	*2,045½	*1,995	*50½	102	*17	119
Swan—						
Guildford Municipality ...	*12	...	*12	*1	...	*1
Guildford	215½	38½	177	*270	7	*277
Midland Junction	11	*101	112	*202	*10	*192
Mundaring	*147	*108	*39	*34	13	*47
Gingin	*783	*479	*304	*311	*170	*141
Moora	*198	339	*537	498	251	247
North Perth and Bayswater (part of)	*8	*8	...	...	...	...
Total, Swan	*921½	*318½	*603	*320	91	*411
Northam—						
Northam	*1,810	*2,079	269	955	153	802
Newcastle	2,342	504	1,838	452	625	*173
Total, Northam	532	*1,575	2,107	1,407	778	629
York—						
York	1,066	701	365	665	489	176
Beverley	3,692	2,624	1,068	750	491	259
Pingelly	3,023	2,267	756	163	179	*16
Total, York	7,781	5,592	2,189	1,578	1,159	419

* Denotes Decrease.

ESTIMATED HAY AND GRAIN AREAS—*continued.*

Magisterial and Police Districts.	Estimated Area laid down, Season 1905-1906.					
	Wheat.			Oats.		
	Total Area.	For Grain.	For Hay.	Total Area.	For Grain.	For Hay.
	acres.	acres.	acres.	acres.	acres.	acres.
SOUTH-WESTERN PORTION.						
Perth—						
Subiaco	2½	...	2½	13	...	13
North Perth and Bayswater (part of)	...	...	...	5	...	5
Victoria Park (part of)	16	...	16	24	...	24
Wanneroo	...	...	...	4	...	4
Kelmscott	269½	72½	197	187	28	159
Claremont	...	...	...	1	...	1
Total, Perth	288	72½	215½	234	28	206
Fremantle—						
Beaconsfield	16½	...	16½	24	...	24
Rockingham	43	8	35	118	5	113
Fremantle...	79	2	77	122	...	122
Total, Fremantle ...	138½	10	128½	264	5	259
Murray—						
Pinjarra	409	114	295	829	60	769
Jarrahdale	155½	45	110½	386	...	386
Waroona	182½	43	139½	647	17	630
Total, Murray	747	202	545	1,862	77	1,785
Wellington—						
Bunbury	901½	425	476½	2,949	286	2,663
Yarloop	151½	53½	98	668	51	617
Collie (part of)	48	24	24	37	...	37
Donnybrook (part of)	83½	45	38½	351	10	341
Total, Wellington ...	1,184½	547½	637	4,005	347	3,658
Collie—						
Collie (part of)	49	...	49	78	...	78
Williams—						
Williams	3,380	1,971	1,409	646	352	294
Narrogin	15,292	11,410	3,882	1,635	1,032	603
Total, Williams	18,672	13,381	5,291	2,281	1,384	897

ESTIMATED HAY AND GRAIN AREAS—*continued.*

Magisterial and Police Districts.	Area actually laid down, Season 1904-1905.					
	Wheat.			Oats.		
	Total Area.	For Grain.	For Hay.	Total Area.	For Grain.	For Hay.
	acres.	acres.	acres.	acres.	acres.	acres.
SOUTH-WESTERN PORTION.						
Perth—						
Subiaco	11	...	11	28	4	24
North Perth and Bayswater (part of)	3	...	3	3	...	3
Victoria Park (part of)	4	...	4	37	...	37
Kelmscott	340	29	311	489	41	448
Claremont	3	...	...	...	...	...
Total, Perth	361	29	332	557	45	512
Fremantle—						
Beaconsfield	2	...	2	33	...	33
Rockingham	9	...	9	133	...	133
Fremantle	29	...	29	143	...	143
Total, Fremantle ...	40	...	40	309	...	309
Murray—						
Pinjarra	252	93	159	1,274	70	1,204
Jarrahdale	290	32	258	449	...	449
Waroona	251	67	184	870	42	828
Total, Murray	793	192	601	2,593	112	2,481
Wellington—						
Bunbury	724	316	408	3,094	242	2,852
Yarloop	263	46	217	990	25	965
Collie (part of)	32	23	9	25	10	15
Donnybrook (part of)	94	54	40	666	21	645
Total, Wellington ...	1,113	439	674	4,775	298	4,477
Collie—						
Collie (part of)	28	...	28	148	...	148
Williams—						
Williams	3,706	2,031	1,675	305	154	151
Narrogin	14,209	11,217	2,992	799	380	419
Total, Williams	17,915	13,248	4,667	1,104	534	570

ESTIMATED HAY AND GRAIN AREAS—*continued.*

Magisterial and Police Districts.	Increase or Decrease for present Season, 1905-1906.					
	Wheat.			Oats.		
	Total Area.	For Grain.	For Hay.	Total Area.	For Grain.	For Hay.
	acres.	acres.	acres.	acres.	acres.	acres.
SOUTH-WESTERN PORTION.						
Perth—						
Subiaco	*8½	...	*8½	*15	*4	*11
North Perth and Bayswater (part of)	*3	...	*3	2	...	2
Victoria Park (part of)	12	...	12	*13	...	*13
Wanneroo	...	...	...	4	...	4
Kelmscott	*70½	43½	*114	*302	*13	*289
Claremont	*3	...	*3	1	...	1
Total, Perth	*73	43½	116½	*323	*17	*306
Fremantle—						
Beaconsfield	14½	...	14½	*9	...	*9
Rockingham	34	8	26	*15	5	*20
Fremantle	50	2	48	*21	...	*21
Total, Fremantle ...	98½	10	88½	*45	5	*50
Murray—						
Pinjarra	157	21	136	*445	*10	*435
Jarrahdale	*134½	13	*147½	*63	...	*63
Waroona	*68½	*24	*44½	*223	*25	*198
Total, Murray	*46	10	*56	*731	*35	*696
Wellington—						
Bunbury	177½	109	68½	*145	44	*189
Yarloop	*111½	7½	*119	*322	26	*348
Collie (part of)	16	1	15	12	*10	22
Donnybrook (part of)	*10½	*9	*1½	*315	*11	*304
Total, Wellington ...	71½	108½	*37	*770	49	*819
Collie—						
Collie (part of)	21	...	21	*70	...	*70
Williams—						
Williams	*326	*60	*266	341	198	143
Narrogin	1,083	193	890	836	652	184
Total, Williams	757	133	624	1,777	850	327

* Denotes Decrease.

ESTIMATED HAY AND GRAIN AREAS—*continued.*

Magisterial and Police Districts.	Estimated Area laid down, Season 1905-1906.					
	Wheat.			Oats.		
	Total Area.	For Grain.	For Hay.	Total Area.	For Grain.	For Hay.
	acres.	acres.	acres.	acres.	acres.	acres.
SOUTH-WESTERN PORTION.						
Katanning—						
Katanning	26,322	21,163	5,159	4,315	2,243	2,072
Wagin	20,140	16,176	3,964	3,123	1,593	1,530
Broomehill	7,208	5,270	1,938	1,209	351	858
Kojonup	1,912	1,312	600	756	413	343
Total, Katanning ...	55,582	43,921	11,661	9,403	4,600	4,803
Blackwood—						
Bridgetown	544	243	301	1,114	210	904
Donnybrook (part of)	30	3	27	426	136	290
Greenbushes (part of)	97	...	97	306	...	306
Total, Blackwood ...	671	246	425	1,846	346	1,500
Sussex—						
Busselton	232	91	141	567	18	549
Hamelin	2	...	2	105	2	103
Greenbushes (part of)	11	1	10	11	...	11
Total, Sussex	245	92	153	683	20	663
Plantagenet—						
Albany	139	28	111	80	10	70
Mount Barker	927	404	523	354	65	289
Total, Plantagenet ...	1,066	432	634	434	75	359
Phillips River—						
Ravensthorpe	475	30	445	256	5	251
Dundas—						
Dundas	729	30	699	23	12	11
Esperance—						
Esperance...	177	45	132	16	1	15
Grand Total, Western Australia	267,717	182,579½	85,137½	40,159	16,861	23,298

ESTIMATED HAY AND GRAIN AREAS—*continued.*

Magisterial and Police Districts.	Area actually laid down, season 1904-1905.					
	Wheat.			Oats.		
	Total Area.	For Grain.	For Hay.	Total Area.	For Grain.	For Hay.
	acres.	acres.	acres.	acres.	acres.	acres.
SOUTH-WESTERN PORTION.						
Katanning—						
Katanning	28,663	23,590	5,073	3,628	2,041	1,587
Wagin	17,686	14,922	2,764	2,682	1,474	1,208
Broomehill	7,577	5,270	2,307	1,546	524	1,022
Kojonup	2,681	2,117	564	1,033	472	561
Total, Katanning ...	56,607	45,899	10,708	8,889	4,511	4,378
Blackwood—						
Bridgetown	715	462	253	1,340	327	1,013
Donnybrook (part of)	37	24	13	490	107	383
Greenbushes (part of)	129	24	105	471	12	459
Total, Blackwood ...	881	510	371	2,301	446	1,855
Sussex—						
Busselton	209	81	128	629	22	607
Hamelin	...	...	...	5	...	5
Greenbushes (part of)	1	...	1	16	...	16
Total, Sussex	210	81	129	650	22	628
Plantagenet—						
Albany	98	25	73	59	...	59
Mount Barker	1,056	474	582	399	109	290
Total, Plantagenet ...	1,154	499	655	458	109	349
Phillips River—						
Ravensthorpe	467	55	412	215	...	215
Dundas—						
Dundas	740	...	740	...	...	...
Esperance—						
Esperance	185	3	182	31	...	31
Grand Total, Western Australia	261,759	182,074	79,685	37,747	13,864	23,883

ESTIMATED HAY AND GRAIN AREAS—*continued.*

Magisterial and Police Districts.	Increase or Decrease for present Season (1905-1906).					
	Wheat.			Oats.		
	Total Area.	For Grain.	For Hay.	Total Area.	For Grain.	For Hay.
	acres.	acres.	acres.	acres.	acres.	acres.
SOUTH-WESTERN PORTION.						
Katanning—						
Katanning	*2,341	*2,427	86	687	202	485
Wagin	2,454	1,254	1,200	441	119	322
Broomehill	*369	...	*369	*337	*173	*164
Kojonup	*769	*805	36	*277	*59	*218
Total, Katanning ...	*1,025	*1,978	953	514	89	425
Blackwood—						
Bridgetown	*171	*219	48	*226	*117	*100
Donnybrook (part of)	*7	*21	14	*64	29	*93
Greenbushes (part of)	*32	*24	*8	*165	*12	*153
Total, Blackwood ...	*210	*264	54	*455	*100	*355
Sussex—						
Busselton	23	10	13	*62	*4	*58
Hamelin	2	...	2	100	2	98
Greenbushes (part of)	10	1	9	*5	...	*5
Total, Sussex	35	11	24	33	*2	35
Plantagenet—						
Albany	41	3	38	21	10	11
Mount Barker	*129	*70	*59	*45	*44	*1
Total, Plantagenet ...	*88	*67	*21	*24	*34	10
Phillips River—						
Ravensthorpe	8	*25	33	41	5	36
Dundas—						
Dundas	*11	30	*41	23	12	11
Esperance—						
Esperance	*8	42	*50	*15	1	*16
Grand Total, Western Australia	5,958	505½	5,452½	2,412	2,997	*585

* Denotes decrease.

MILK FEVER: ITS SIMPLE AND SUCCESSFUL TREATMENT.

(*Continued.*)

If the head is drawn out straight, it immediately flops around to the side again when the force is removed. The body usually rests slightly to one side, with the hind legs extended forward and outward and the fore legs doubled up in their normal position. There is paralysis of the muscles of the throat, so that swallowing is impossible, and in case drenching is attempted there is great danger of the fluids going into the lungs and setting up traumatic pneumonia. Paralysis of the rectum and bladder is also complete and the movement of the intestines is so suppressed that purgatives are frequently powerless to re-establish it. Fermentation in the paunch with consequent bloating is sometimes seen, particularly when the patient is allowed to be stretched out on her side. The secretion of milk is diminished and may be suspended entirely. Sugar is voided in the urine, depending in quantity on the severity of the attack. The pulse is weak and at times hardly perceptible to the finger, averaging from 50 to 70 beats per minute. Later in the disease, however, and especially in those cases with unfavourable terminations, it may reach 100 per minute. There is seldom noticed a rise of temperature. Sometimes at the commencement of the attack the temperature may reach 103° F., but there is a steady decrease to as low as 95° F. as the diseases progresses. The temperature rapidly rises again as improvement is manifested. Convalescence occurs rapidly, and on the day following the onset of the disease, and in some cases even within a few hours, the animal may be up eating and drinking in a normal manner. Sometimes, however, a slight paralysis of the hind quarters persists, and may remain for a week or even longer, indicating that some structural change must have occurred in the nerve centres. In fatal cases the animal may remain perfectly quiet and die in a comatose condition from complete paralysis of the nervous system, but more frequently there is some agitation and excitement prior to death with tossing about of the head. Death, like recovery, usually occurs in from 18 to 72 hours after the onset of the malady.

Appearance after Death.

The post mortem appearances in an animal dead of this disease are frequently entirely negative and not in the slightest degree characteristic. This further upholds the theory that milk fever is an intoxication and not a bacterial infection, as in the latter case the lesions would be more marked and distinguishable. The post mortem also fails to substantiate the fermentation theory of Schmidt-Mühlheim, as the uterus is generally found contracted and its mucous membrane intact. The third stomach is sometimes found impacted with dry, hard masses of food, and there may be some fermentation in the intestines. Sugar in varying percentage is always found in the urine in the bladder as well as in that drawn prior to death. Various particles of food may be found in the larynx together with congestion and swelling of the mucous membrane of the trachea and bronchi. Pneumonia,

traumatic in origin, may also be observed if drenching has been attempted after paralysis of the throat has occurred. The blood usually appears dark and thick and congestion of the spinal cord and of the base of the brain is also quite frequently present.

Prognosis and Mortality.

Prior to the introduction of the Schmidt treatment milk fever was considered an exceedingly serious malady and the death rate was placed by various authors at 40 to 50 and even 70 per cent. However, after the introduction and general application of potassium iodide injections into the udder, the mortality was reduced in Denmark and Germany to 17 per cent., in Switzerland to 22 per cent., and in Austria to 25 per cent., while in this country the statistics collated at the Iowa Experiment Station show 119 recoveries without complication out of 166 cases, a mortality of 28 per cent. Since the use of sterile atmospheric air for the injection of the udder, the death rate is even much lower than with the potassium iodide treatment, and in Denmark out of 914 patients, 884, or 96·7 per cent., recovered. In general, the nearer the attack follows the act of calving the more severe it proves and the graver the danger. The severity also greatly increases with each subsequent attack.

Treatment.

In the administration of medicine by the mouth, and especially drenches, great care should be taken to prevent the fluids from getting into the larynx and from there into the lungs, where they will set up traumatic pneumonia, which is almost invariably fatal. In case the throat is not paralysed the drench may prove of value and should be given slowly, and immediately stopped at the first sign of uneasiness or coughing on the part of the animal. While the patient lies on the side she must raise the weight of her body at each inspiration, which is very exhausting, and hypostatic congestion of the dependent lung is greatly favoured. Consequently it is of importance that the cow should be kept propped up on the breastbone by means of bags of chaff or straw placed against her side. In the way of medicinal treatment purgatives may be given in the first stage of the disease when the animal can swallow, with the precautions above mentioned. One pound of Epsom salts and 2 ounces of creolin dissolved in a pint of water will prove beneficial. The creolin is added for its antiseptic action to prevent fermentation in the paunch with the consequent danger of the eructation of foods and their subsequent passage into the windpipe. Ammonium carbonate, in 2-dram doses, dissolved in 2 ounces of water, will be found to act equally as well as the creolin in this respect. Epsom salts is rather slow in its action, and an injection under the skin with a hypodermic syringe of $1\frac{1}{2}$ to 2 grains of eserine sulphate, when obtainable, will be found quicker and more efficacious. The rectum should be emptied, and injections of 1 to 2 gallons of warm water given to stimulate intestinal movements. However, the normal movements of the bowels, once lost, is exceedingly hard to re-establish, and sometimes all efforts in that direction fail. The urine should be drawn with a catheter, or by pressure on the bladder with the hand in the rectum, as the bladder is paralysed and unable to empty itself.

The feeble pulse and subnormal temperature call for the administration of stimulants. Injections under the skin of 1 dram of the following solution

every three hours are probably the most efficacious: Eighty grains of caffein, 60 grains of sodium salicylate, and 4 drams of water. Similar injections of 1 grain of strychnia sulphate, three times daily, will also be found very beneficial, although numerous other drugs may be recommended, as spirits of camphor, veratrin, tincture of digitalis, alcohol, etc. In case the animal is very excitable, the head should be restrained in such a manner as to prevent injury, and, in case the violence becomes excessive, $1\frac{1}{2}$ ounces of chloral dissolved in a quart of water may be injected into the rectum, or 5 grains of morphine sulphate under the skin.

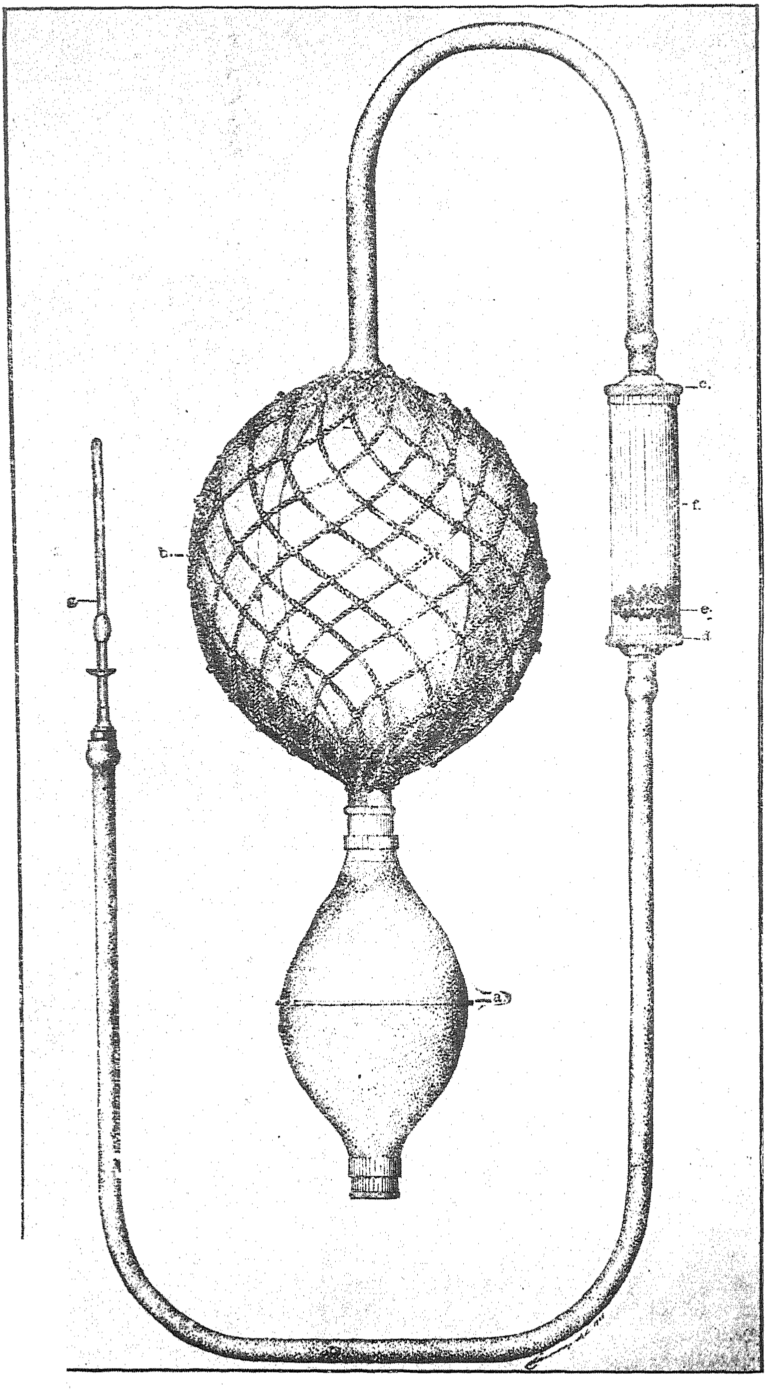
The Potassium Iodide Treatment.

As previously stated, Schmidt, of Kolding, advanced the theory in 1897 that the cause of milk fever was the absorption of leucomaines from the udder, and recommended that potassium iodide be injected to prevent the formation of the toxin, and to neutralise that already existing. This was the most rational theory so far advanced, and the treatment proved to be beneficial, being followed by astonishingly good results. After this treatment was generally resorted to throughout Europe and America, the death rate fell from 40 per cent. to 17 per cent. The apparatus required for the Schmidt treatment is exceedingly simple, and consists of a piece of rubber tubing about 4 feet long, to one end of which is attached an ordinary milking tube, which is inserted into the teat. At the other end a funnel is fitted, into which the solution is poured. Previous to the injection the udder should be thoroughly milked out, and washed off with warm water and soap, followed by a 5 per cent. solution of carbolic acid or creolin. A clean towel should be placed under the udder to keep it from coming in contact with the stable litter or other filth. Two and one-half drams of potassium iodide are then added to one quart of water previously boiled for 15 minutes, and allowed to cool to the temperature of the body. The funnel and tubing should likewise be disinfected before the injection. The milking tube is inserted into the four teats in succession, each quarter of the udder, after it has been milked out clean, receiving one half-pint of the liquid. The udder should then be thoroughly massaged to make sure that the milk canals are penetrated by the liquid. In case improvement does not occur, the injection may be repeated once or twice at intervals of eight hours, always observing the same antiseptic precautions, as it is possible to produce a dangerous mammitis (caked bag), and ruin the udder by careless injections, which introduce pathogenic bacteria. This danger, however, is entirely obviated by the use of ordinary antiseptic precautions, as described above.

The New Air Treatment.

Of all known methods of treating milk fever, the injection of sterile atmospheric air into the udder is by far the most simple and practicable, as well as the most efficacious and harmless one at our disposal, and only occasionally requires that medicinal treatment be given.

For a considerable length of time the entire value of Schmidt's treatment was considered to be the antitoxic action of potassium iodide, and soon numerous investigators began injecting various other antiseptics, such as carbolic acid, creolin, etc., with equally good results. Sterile water and sterile salt solution were tried with no increase in the mortality, and it was therefore considered that the distention of the udder was as important a



RATUS FOR INJECTING STERILE ATMOSPHERIC AIR INTO THE UDDER.

factor as the antitoxic action of the iodide of potash. Continuing along these lines, Kortman used antiseptic gases (etherised air) with beneficial results. Oxygen was then tried by Knüsel, with increasing success, and the deaths among the experimental cases virtually ceased. The apparatus for treating with oxygen and etherised air, however, are expensive and cumbersome, and this greatly limits their use by the average practitioner.

To Andersen, of Skanderborg, belongs the credit of first having made use of plain atmospheric air, although Schmidt had previously recommended the admittance of air with the potassium iodide solution for the purpose of obtaining greater diffusion of the liquid. Andersen first injected air along with sterile water and then by itself. The results were astonishingly successful. Thus Schmidt reports that out of 914 cases treated in Denmark, 884, or 96·7 per cent., were restored to health. The record of 140 of these animals shows that recovery occurred in the average time of $6\frac{2}{3}$ hours. Of this number 25 cases required a second injection, while in three of the latter number it was necessary to give a third treatment before they were able to get upon their feet. The treatment is also practically harmless, as the statistics of the above-mentioned 914 patients show that only one cow was affected with a severe attack of caked bag after this treatment, while in four other cows a milder inflammation of the udder was apparent. Equally good results have likewise been obtained in this country.

The method of injecting filtered air into the udder is easy of manipulation, requires but little time, and is readily accomplished by means of a milk-fever apparatus, such as is illustrated in fig 2.* It consists of a metal cylinder *f* with milled screw-caps *c* and *d* on either end. Cap *c* may be removed in order to place sterile absorbent cotton within the chamber. To this cap the rubber bellows *a* and *b* are connected by nine inches of rubber tubing. Cap *d* is to be removed together with the attached 18 inches of rubber hose, at the free end of which is the self-retaining milking tube *g*, for the purpose of disinfection before treating each case. The pulling on or off of the tubing on the nozzles of the milled caps is thus rendered unnecessary. Within the metal cylinder at *e* is a wire net, which prevents the obstruction of the outlet of the chamber by holding back the sterile cotton, and also permits of the unscrewing of the lower cap and the disinfection of this portion of the apparatus, including the milking tube, without contaminating the packing. Absorbent cotton impregnated with carbolic acid (carbolised cotton) or other suitable disinfectant can be purchased from the drug trade in most localities, and is better, though slightly more expensive, than the plain cotton.

Previous to making the air injection, the hands of the operator should be thoroughly cleansed and the udder should receive the same careful antiseptic treatment as has been recommended in discussing the injection of potassium iodide. Soap and water should be applied to the teats and udder, after which they should be carefully disinfected with a 5 per cent. solution of carbolic acid (three tablespoonfuls of pure carbolic acid to one quart of water). A clean towel should then be placed under the udder to prevent the teats from coming in contact with dirt or filth of any kind. The milking tube, before it is placed in the teat, should have been perfectly sterilised by boiling for 15 minutes with the lower hose and cap of the cylinder attached,

* Persons desiring the name and address of firms manufacturing milk-fever outfits, together with the price of same, will be furnished with such information upon application to the Chief of the Bureau of Animal Industry.

and the apparatus should be wrapped in a clean towel, without touching the milking tube, to prevent contamination before use. If the apparatus has been subjected to this treatment shortly before and it is desired to disinfect only the milking tube, the latter may be placed in a 5 per cent. solution of carbolic acid for five minutes. It is then carefully inserted into the milk duct of the teat without emptying the udder of milk. Air is now pumped from the bulb *a* into the reservoir *b*, and thus a continuous flow of air is forced through the filtering chamber and into the udder. Slight massage or kneading of the udder will cause the innermost recesses of the milk tubules to become distended with the injected air. After one-quarter of the udder is well distended the milking tube is removed, care being taken to prevent the outflow of air by having an assistant tie a broad piece of tape about the teat at the time the milking tube is withdrawn. The same treatment is repeated with the other three teats until the udder is satisfactorily distended. In case the air becomes absorbed and no improvement is noted within five hours, a repetition of this treatment should be made under the same antiseptic precautions as at first. The tape should be removed from the teats two or three hours after the cow gets on her feet, the constricting muscles at the tip of the teats being now depended on for retaining the air. In this manner the air may be left in the udder for 24 hours, and when recovery is assured, it should be gradually milked out. It is needless to say that the calf should not be permitted to suck during this period.

Inflammation of the udder (caked bag) is avoided if the milking tube is thoroughly disinfected before each application, and if the cow's teats and bag and the hands of the operator have been properly cleansed. If the apparatus is kept in its case free from dust and dirt, the absorbent or medicated cotton in the metal cylinder will efficiently filter enough air to distend the udders of six cows. After this number has been treated it is advisable to replace the old cotton with a fresh sterile supply, which should be placed loosely in the cylinder. *

While this method of treating milk fever is a comparatively easy one for a farmer or dairyman to adopt, he can not expect to have the same successful results as those obtained by a skilled veterinarian, and it is therefore advisable that the services of such a veterinarian should always be obtained in those districts where it is possible. In many cases it will be found that the injection of air into the udder will be sufficient to combat the disease without any other treatment, but it is always advisable to study the symptoms of each individual case and administer in a rational manner the indicated medicines.

Prevention.

Until recently most stringent measures were resorted to by every careful dairyman to prevent the development of the disease in his herd. However, since the treatment of the present day has so greatly reduced, and even in some cases obliterated, the mortality, prevention is no longer such an important problem, and therefore preventive measures which have a severe and lasting effect upon the animals should be abandoned from an economic standpoint. It has long been advocated to starve all suspected animals for two weeks prior to the birth of the calf. It is frequently noted that this has

* A number of bacteriological tests were made in order to determine the efficiency of the absorbent cotton in the cylinder to filter out the micro-organisms from the atmospheric air. For this purpose agar plates and slant agar tubes were used, and the results obtained proved the absolute certainty of this quantity of cotton filtering successfully a sufficient volume of air to distend six good-sized udders.

an injurious effect on the milk flow of the animal, from which it may require several weeks for her to recover and gain her normal output of milk. This measure is no longer considered advisable, as it is better to have cows attacked with the disease once in a while (the mortality being less than 5 per cent.) than to decrease the flow from every heavy-milking cow for one to three weeks after she comes fresh by starving her before calving.

A method which is not quite so sure of reducing the plethoric condition of the cow, but which nevertheless proves very efficient and is without the slightest permanent injurious effect, is the administration of 1 to 1½ pounds of Epsom salts two or three days prior to calving. In case this has been neglected and a well-nourished, heavy-milking cow has passed through an easy non-exhausting calf birth, the administration of the salts after the labour is over should by no means be neglected. Blood-letting has also been advocated, but there is always the danger of exciting the blood-making organs to excessive activity, thus largely neutralising the effect. It should therefore be resorted to only when the cow is extremely fat, is a heavy milker, and has had one or more previous attacks. The blood should be drawn from the jugular vein until the pulse softens perceptibly, 1½ pints for every 100 pounds of the animal's body weight being about the right amount.

Another very good preventive measure, and one easily carried out, though frequently overlooked, is to give the cow plenty of exercise up to the time of calving. Many animals are allowed to run continuously on pastures from the time they go dry until a week or two before calving, when they are transferred to the stable without any subsequent exercise. This is very conducive to the enriching of the blood and the development of the disease.

The most recent preventive treatment suggested is in line with the favourable results obtained by the injection of air into the udder. It consists in allowing the susceptible cow to retain in the udder for 24 hours after calving all the milk except the small quantity required by the calf, which should be taken if possible from each quarter. The distension of the udder naturally follows as in the air treatment, and acts as a preventive against milk fever. In the Island of Jersey, and at the Biltmore Farms, N.C., where this practice is common, the number of milk fever cases has been greatly lessened. General sanitary conditions should also be looked after, such as the supply of pure air and clean stabling, with plenty of clear, cool water and laxative foods, such as grasses and roots. Some observers who believe in the microbic origin of the disease have recommended the cleaning of the manure and dirt from the animal and spraying the hind quarters and genitals with a four to five per cent. solution of carbolic acid, lysol, or creolin, just prior to calving. From our present knowledge of the disease, however, this is probably unnecessary.

GARDEN NOTES FOR DECEMBER.

By Percy G. Wicken.

The season having, the same as last year, been a late one, up to the time of writing these notes no hot weather has been experienced, consequently garden produce still keeps at its best and a plentiful supply is available in the city markets. Now is the time for those who have suffered from excessive wet during the winter to think about laying out a system of underground drains. Agricultural drain pipes are now made in the State and can be obtained at a very reasonable rate, and although pipes may be a little more expensive in the first instance than other systems, they are the most effective, last longer, and in the end prove cheaper. If observations are made during the winter as to where the water accumulates most in the soil, an idea can soon be obtained as to where the drains can be most effectively placed. In sandy soil drains about 40 feet apart will prove sufficient, but in more retentive soils they will require to be placed closer together. Draining keeps the ground moister and enables the plants to send their roots deeper into the ground in the dry weather, as well as to carry off the surplus water during the winter. The Royal Agricultural Show was held at the beginning of this month at Claremont, at which the exhibits of vegetables were conspicuous by their absence. Considering the number of market gardens, as well as the number of amateur gardeners, that are to be found in the vicinity of Perth, Fremantle, and the suburbs, one would expect to see a large number of entries in the vegetable section and keen competition for the prizes. Whether this is due to a want of energy among gardeners who do not care to take the trouble to prepare an exhibit, or due to modesty through thinking they cannot secure the prizes, the fact remains that the exhibits were remarkably few. It is to be hoped that next year we shall find this section considerably improved and a large number of entries made, so as to give visitors an idea as to the quality of vegetables we can produce in this State, which are as good as can be produced elsewhere, although a visitor to the Show would carry away a different impression. What few exhibits shown were of a good quality and able to keep up our reputation. The principal work in the garden this month is to keep the ground well stirred between the plants and to cut down any weeds as soon as they appear, as the plants require the full use of the ground at this time of the year.

Beans (French or Kidney) are now coming in plentifully. The pods should be picked before they become too old, as if left to mature their seeds they soon cease bearing. A few more rows may be sown to keep up a supply.

Beans (Lima).—Early-sown plants of the climbing varieties will soon require staking. A further supply may be sown in moist localities.

Beet (Silver) should now be giving a plentiful supply of green leaves; the other leaves should be cut off as soon as they mature. They make an excellent vegetable, and are also valuable as green feed for poultry during the dry weather.

Cabbage.—Cultivate well round those now growing. A few more plants may be put out, but they will require shading from the sun.

CELERY.—Plants at present growing will require hilling up to cause them to bleach. In moist localities a few more rows may be sown.

CHOKOS.—Those planted last month should now be sending out runners. They climb well and bear a large number of fruits, somewhat resembling a small squash. A few more fruits that have begun to shoot may be planted out.

CUCUMBERS.—Fruit from the early-sown plants are now plentiful. In moist localities, a little more seed may be sown; but worms are likely to prove troublesome and should be kept in check by laying some pollard mixed with Paris Green to poison them.

EGG PLANTS.—Plant out any plants you have available and shade well from the sun until they become established. A few more seeds can be sown.

MAIZE (Sweet).—Cultivate well between the rows of the plants already up. Table maize makes a splendid addition to the *menu* when properly served up. It should be more extensively cultivated. A further supply of seed may be sown in moist localities. The cobs should be pulled when they are soft and full of milk and not allowed to become hard.

MELONS.—Early rock melons should be plentiful and the later varieties coming along rapidly. In the early districts, the first water melons should be soon available. Keep the ground well stirred until the vines cover the ground.

PUMPKINS AND SQUASHES.—The early squashes and marrows are now plentiful; the harder and better-keeping ones do not mature until later in the season. Keep the ground worked between the vines.

OKRAS.—Put out any plants that may be available and shade from the sun until established.

SWEET POTATOES.—The young shoots planted out last month should have taken root by now, and a further supply can be put out, but must be shaded until they obtain a root hold. They should be planted on hills, and the ground kept well stirred until the vines cover the ground.

TOMATOES.—From the warmer localities a supply of early fruit should be coming to market. In the cooler districts a further supply of plants can be planted out. The plants should be staked and kept off the ground, as the fruit is not so liable to be attacked by fungus diseases. As the supply becomes plentiful, only the best qualities obtain a payable price, and therefore seed of only the smooth-skinned varieties should be sown.

FARM.—This is a busy time on the farm. By the time these notes appear hay-making will be almost over, and the grain harvest well forward in the earlier districts. As soon as a haystack is built, a fire break should be ploughed all round it; also as the grass paddocks become dry, a fire break should be ploughed all round the fences, and every precaution taken to prevent an outbreak of fire. When the grain harvest commences, particular attention should be paid to those varieties of wheat which are known to shed their grain easily. These must be cut directly they reach the ripening stage, otherwise the grain shells out, and a loss of several bushels per acre is likely to result. The yield this season promises to be light on the average, although reports of some excellent crops have come to hand. The season has been somewhat similar to last year, and the yields in the Southern areas have been affected by the excessive wet. In the Northern areas the crops, although somewhat late, are up to the average, and I expect, taken all

through, the general average will be about the same as last year, or perhaps a little less. The increased area under crop will, however, give us much greater supplies.

Where there is sufficient moisture to germinate the seed, such seeds as sorghum, French millet, and cow-pea may be sown, but the horse-hoe cultivator must be kept going between the summer crops so as to conserve as much moisture as possible. As soon as the cereal crops are off, as many sheep as are available should be turned into the stubbles. They will pick up all the lost grains, as well as obtain good feed from the undergrowth left in the stubble. Pigs will also do well in the stubbles, and can be turned off fit for market.

LOCAL MARKETS' REPORTS.

PRODUCE MARKET PRICES.

Wheat.—Perth and Fremantle, 4s. 3d. to 4s. 4d.

Flour.—On spot (Fremantle). South Australian lines are quoted at £9 17s. 6d. for sacks, and 5s. more for 50's. Local brands at mills from £8 7s. 6d. (Northam and Beverley) to £8 17s. 6d. at Fremantle. Manitoba Glenora, £15.

Bran.—Up to £6 15s.

Pollard.—Up to £7 15s.

Chaff.—Wheaten: Prime, £4 17s. 6d. to £5; f.a.q., £4 12s. 6d. to £4 15s.; good medium, £4 to £4 7s. 6d.

Oats.—Algerians, 2s. 4d. to 2s. 5d., Melbourne; 2s. 8d. to 2s. 9d., Fremantle.

Butter.—In Melbourne, best Western district, 11½d., f.o.b.; other lines, 11d. to 10d.; on spot, best Victorian, 1s. 1d¼.

Cheese.—Victorian loaf, 8¾d.; medium, 8½d.; imp. Gruyere, 1s. 3d.; Edams, 11½d.; Stilton, 2s.; Gorgonzola, 2s.; McLarn's Imperial, 14s. 6d. per doz.; Midget cream Goudas, 30s. per doz.; Osborne's Federal, 13s.

Bacon.—On spot, Farmer's 9½d.; Castle, 8¾d.

Hams.—English, Hunter's, 1s. 2s.; Farmer's, 1s. 1d.; Swift's American, 1s. 1d.

Lard.—Imported, in bladders or 1lb. pats, 7¾d.; Swift's American Silver Leaf, 7d.

Eggs.—The Adelaide quotation, f.o.b., to-day is 6½d,, and on spot values of South Australian 10½d. At auction fresh local eggs are selling up to 1s. 3d.

Potatoes.—Local to £16, imported to £12.

Onions.—Local up to £22; imported to £23.

CURRENT MARKET RATES.

Eastern Produce.—Rice: Japan is quoted at £22 10s. per ton. Tapioca, small pearl, 22s.; medium, 22s. 6d. White pepper is quoted at 1s. 2d.; whole black, 11d.; "Star" ground, white, 1lb. tins, 14s., ½'s 7s., ¼'s 3s. 6d. Nutmegs, 1s. 6d. to 1s. 9d. Cloves, 1s. Pimento, 8½d. Whole white ginger, best, 11d.; brown, 10d.

Dried Fruits.—Currants, half-cases, 4½d.; cleaned, half-cases, 4¾d.; 1lb. packets, Kuxjoy, 5s. 3d. Jack apples, new season's pkt., 9d.; loose, 8d. Apricots, Mildura or Renmark, S. 9d., D. 8d. Peaches, Mildura or Renmark, S. 10¼d., D. 9½d. Sultanas: Ordinary, 5½d. to 5¾d., according to sample; cleaned, 1lb. packets, 6s. 9d. Soft-shell almonds, 7d. Muscatels, 1s. 2½d.; California do., 10¼d.; Mildura, 10½d. Candied peel: Lemon, 6¾d.; orange, 8d.; citron, 1s. Lexia raisins: Three Crown Golden, 7¾d.; Three Crown Brown, extra, 7d.; Three Crown Brown, 6¾d. Seeded raisins, 1lb.

packets, 7s. 9d.; Rose, 6s. 6d.; Flag, 6d. per lb. Dates, new season's, 3d. Nuts: Brazil, 9d.; Barcelona, 8d.; walnuts, 8d.; Jordan almonds, 2s. 3d. Figs: Brick-shaped boxes, 5s. 6d.; glove-shaped do., 5s. 9d.; pulled, in 7lb., 10lb., and 14lb. boxes, 7¾d.

Preserved Fish.—Herrings: Fresh, Smith's, 4s. 7½d.; Milne's, 4s. 7½d.; Maconochie's, 4s. 7½d.,; Tyne Packing Co., 4s. 7½d.; Mon Wilson, 4s. 6d.; kippered, Smith's, 6s. 4½d.; Tyne Packing Co., 6s. 3d.; H. Thiis, 6s. 6d.; Mandurah, 6s. 3d.; in tomato sauce, Bruce's, 6s. 9d.; Moir Wilson, 6s.; salt, ½bbl., 22s. 6d. Mandurah mullet, 6s. 3d. Halibut, large tins, 13s. Sardines: ¼'s, 2s. 9d. to 2s. 6d.; do. with keys, 3s. 6d. to 3s. 3d.; 1-8's, 2s. 4½d. to 2s. 1½d.; ½'s, 4s. 9d. to 4s. 4½d.; smoked, H. Thiis, ½'s, 7s. 9d., ¼'s, 4s. 7½d.; Valvatus, 4s.; Aurora, ¼'s, 4s. 6d.; ½'s, 6s. 6d. Salmon: Karluk, Horseshoe, 7s.; scroll, flats, 1lb., 9s.; ½lb., 5s. 9d.; Karluk Pioneer, 7s.; Red Star, 7s. 9d.; pink, 5s. 6d.; Red Clover, 8s.; Monarch, 1lb., 9s. 3d.; ½'s, 5s. 7½d.; pickled, ½bbl, 35s. Oysters: Kensett's, 5s. 9d.; Continental, 5s., Sunrise, 5s. Sliced mackerel, ¼'s, 8s. 3d.; Excelsior, 7s. 6d. Barracouta: Fresh IXL, 1lb., 5s. 6d.; kippered IXL, 1lb., 6s. 6d. Ling: Astrop's, 7¾d. Haddock: Smith's, 7s. 6d.; Moir Wilson, 6s. 9d. Shrimps: Red Star 1lb. 14s., ½'s 8s. Lobster: Exposition 19s. 3d.; Dagmar, 17s.; Beaver, 19s. Whitebait: St. George's, 20s.; Woods', 20s.; Frost's New Zealand, 19s. 6d.

Tinned Meats.—Sydney, 1lb. assorted, 7s. 4½d.; Globe, do., 7s. 4½d.; Fitzroy, do., 1lb. 7s.; 2lb., 13s. 6d.; Fitzroy, 1lb., luncheon beef, 9s. 3d., hamper, 1lb. corned beef, 6s. 6d.; 2lb., 11s. 9d.; Union, 1lb. corned beef, 6s. 6d.; Gippsland 1lb. assorted, 7s.; Fitzroy, 1lb., tripe, 7s. 3d.; 2lb., 13s. 6d.; Libby's, 1lb., sliced bacon, 13s. 6d. to 15s. 6d.; sliced ham, 15s. 9d.; ham loaf, 10s. 6d. to 11s.; veal loaf, 10s. 6d. to 10s. 9d.; luncheon loaf, 10s. 6d. Hamburger loaf, 10s. 6d.; chicken loaf, 15s.; jellied hocks, 10s. 9d.; pigs-feet, 8s. 9d.; Turk and Pabst's Frankfort sausages, 4's 14s., 6's 17s., 8's 19s. 6d.; Joubert's Fritz sausage, 14lb. tins, 9¼d.; Armour's 1lb. brawn, 8s.; 1lb. pigs-feet, 8s.; Vienna sausage, ½'s 5s., 1lb. 8s. 9d.; Star ham, 14s. 9d.; Hog's casings (kegs), test 35 per cent., 1s. 9d. per lb.; Christchurch sheep-tongues, 14s. 9d.; Globe, 1lb., 12s.; Libby's ox-tongues, 2lb., 35s.; Globe, 3lb., 36s. Dripping, Bayne's, 2lb., 13s. 9d.; Sydney, 2lb., 10s. 9d.; Victher's, O.K., 10s. 9d.; Fitzroy, 12s. 9d.; Libby's, 2lb., 12s. 9d.; Libb's potted meats, 4oz. tins, 2s. 3d. Meat Extract, Fitzroy, 2oz. 12s.; Epler, 12s.; bovril, 1oz. 9s., 2oz. 15s., 4oz. 28s. 6d.; Oxo, 1oz. 7s. 6d., 2oz. 13s. 3d., 4oz. 23s. 6d. (for three dozen, larger quantities at reduced rates), 16oz. 73s.; Anderson's Leibig, 2oz. 15s.; C. and B. tinned soups, 14s. Rabbit, Robe, 1lb. tins, 6s.

Tinned Vegetables.—Green peas, 5s. 3d. to 5s.; French Beans, 5s. 4½d. to 5s. 3d., according to sample. Tinned tomatoes: S. and A., 7s.; Jones, 6s. 8d.; Lion, 6s. 6d.; A.J.C., 6s. 3d. Preserved potatoes, 7lb. tins, 60s. per cwt.; do. (Muckharts), 14lb. tins, 58s. per cwt. Asparagus: A.J.C., 13s. 6d.; Egyptian lentils, 3d.; Royal Red, 16s.; San Joaquin, 16s. 6d. Sweet corn, 7s. 6d.

Tinned Fruits.—Swallow and Ariell, assorted, 8s. 3d.; Queensland 2lb. sliced pineapple, 6s. 6d.; Rajah pineapples, 5s. 7½d.; V.C. pines, 6s. 6d; A.J.C., assorted, 7s. 3d.; Kensitt's strawberries, new shipment, 10s. 6d.; Jones', assorted, 7s. 9d.; do., apples, 6s. 9d.; do., pears, 9s.; Lion, assorted, 7s. 9d,; do., apples, 6s. 6d.; do., pears, 9s. 3d.; do., plums, 6s. 6d.; Taylor Bros., assorted, 8s.; strawberry conserve, V.C., 11s. 6d.

Jams, etc.—Jones' I.X.L., assorted, 6s. 9d.; Peacock's O.K., 6s. 9d.; Glen Ewan, assorted, 6s. 9d. (slightly lower rates may be obtained for parcels); Glen Osmond, assorted, 6s. 1½d.; Fairbrother's fig, 8s.; Florida do., 7s. 9d.; A.J.C., assorted, 7s.; Taylor Bros.' 2lb. assorted, 6s. 7½d.; Reiss strawberry, 2lb. tins, 11s.; Ketty, Wood, and Co's. strawberry, 13s.; marmalade, A.J.C., 6s. 10½d.; C. and B. do., glass jars., 8s. Golden syrup, English, 6s 9d. to 6s. 3d., according to brand. Bird's jelly powders, 3s. 6d.; do. custard powders, small, 4s. 10½d. to 4s. 7½d.; large, 9s. 9d. to 9s. 3d., according to quantity. "Lion" jelly crystals, 3s. 6d.; "Boss" do., 3s. 3d. to 2s. 9d., according to size of parcel; White's jelly crystals, 3s. 7d½.; Pioneer table jellies, 3s. 9d. Honey, Barnes' (Melbourne), large jars, with comb, 14s. 6d.; small do., 7s. 6d.

Preserves.—Pickles: Captain White's Oriental pickles, large 21s. 6d., small 12s. 9d.; Crosse and Blackwell's West Indian, 16s.; Gillard's pints 14s. 9d., half-pints, 9s.; Convent Gardens, assorted, 7s.; Southan's, 6s. 6d.; I.X.L., 6s. 4½d.; Hayward's 14s. 9d. per box. Free of parcel. Olives: Crosse and Blackwell's half-pints (reputed), 9s. 6d.; half-pints, Imperial, 11s. 6d. Tomato sauce, A.J.C., 5s. 6d. Waw Waw sauce, half-pints 10s. 6d., pints 16s. 6d.; Davenport's "Virgin" olive oil, 5oz. 6s. 3d., 10oz.

11s., quarts, 28s.; C. and B. Lucca oil, 29s. Holbrook's Worcester, ¼'s, 6s. 3d., ½'s, 8s. 3d., pints 16s. 9d. Holbrook's No. 2 ½'s 8s. 3d., do. Jubilee ½'s 7s. 9d.

Oatmeal, etc.—Maori flaked, 2lb. packets, 6s.; I.X.L. flaked, 7lbs., 14s. per cwt. Uncle Toby oats, 2lb. packets, 8s.; 5lb. bags, 16s.; 3lb. tins, 14s. Quaker oats, 2lb. packets, 5 cases, 27s.; under 5 cases, 27s. 3d.; 2lb. tins, 5 cases 28s., under 5 cases 28s. 6d.; 5lb. tins, 5 cases, 26s., under 5 cases, 26s. 3d.; Royal Seal, 2lb. tins 23s. Tam o' Shanter oats, 6s.; "Star" oatmeal 18s. 6d. in 7lb. bags; Avena 19s. 6d. in 7lb. bags, 24s. 6d. in 2lb. packets. Keen Robinson's oatmeal, 7lb. tins, 36s. per cwt. Force Food, 22s. 4d. per case of 3 doz. packets. Grape Nuts five cases 7s. 7½d., single case 7s. 9d,, less 8s. Anchor flaked, 7lb. 16s. 6d. Granuma, 2lb. digestive meal, 6s., 4lb. 10s. 6d.; Semolina, 2lb. packets, 7s. 3d. Anchor Digestive Meal, 4s. 9d. Cornflour, Mohawk, 3d. Wotherspoon's 3¼d. Coleman's Arrozena, 1lb. or ½lb. packets, 4½d. Macaroni, Rinaldi's, 1lb. packets. 4½d. lb. Vermicelli, do. 4½d. lb. Empire self-raising flour, 2lb. packets, 4s. 3d. Egg powder, ¼'s, 4s. 3d. to 4s., according to quantity. Baking powder: Victory, ¼'s 2s. 10½d.; ½'s 4s. 10½d.; 1lb. 8s. 1½d. Anchor, ¼'s 3s. 1½d.; ½'s 5s. 3d.; 1lb., 8s. 9d.

Coffee, Cocoa, etc.—Coffee: "Star," 14s.; Oriental, 18s. Cocoa: "Empire," ¼'s 7s. 6d. to 8s., ½'s 13s. 6d. to 14s., according to parcels. Symington's Essence of Coffee: Large: 5 cases and upwards, 16s. 6d.; 1 to 4 cases, 16s. 9d.; less than case, 17s. Small: 8s., 8s. 1½d., and 8s. 3d. respectively. Cocoa: Bensdorf, ¼'s, 8s. 3d.; ½'s, 15s. 9d. Rowntree's homœpathic, ½'s, 1s. 1½d.

Confectionery, Biscuits, etc.—Mills and Ware's cream fingers, 12s.; Café Noir, 9d., fairy cakes, 8d.; afternoon tea, 15s.; wafers, assorted, 9s.; shortbread creams, 10s.; Xmas. cake, 1½lb. 13s., 2lb. 17s., 3lb. 25s.; block cherry cake, 10d.; Carr's biscuits, afternoon tea, 19s.; wafers, 1s. 5d. lb., and from 7s. 6d. to 9s. 6d. doz.; shortbread, 17s. 6d.; chocolate biscuits, from 13s. 6d. to 18s.; fancy kinds, in ½lb. tins, 9s. to 12s. Huntley and Palmer's biscuits, afternoon tea, 19s.; jam fingers, 13s. 6d.; Café Noir, ½lb. 11s. 6d., 1lb. 18s.; ice-creams, 14s. 6d.; cream fingers, 10s. 6d.; jam fingers, 12s.; mixed creams, 14s. 3d.; Arctic wafers, 14s.; Commodore wafers, 13s.; fancy shortbread, 17s.; glace, 13s. Crystallised fruits, assorted 9s., cherries 9s. 6d.; Fry's chocolates, 1lb. boxes, 1s. 3d.; assorted chocolates, 1s. 3d.; varieties, 1lb. boxes, 1s. 11d.; almonds, 1s. 9d.; nougat, 1s. 3d.; ginger, 1s. 4d.; chocolate cream tablets, 7s. 6d. per gross; assorted fancy boxes, 3s. to 25s.; milk chocolates, large 4s. 6d., medium 2s. 3d., small 9d. Cailler's 1d. tablets, chocolate, 9s. per gross; 3d. do., 2s. 6d. per doz.; 6d. do., 4s. 9d. per doz.; 1s. do., 9s. 3d. per doz.

Sundries.—Beecham's pills (new size), selling at 10½d., 9s. 9d. per dozen for gross parcels, 10s. per dozen for smaller lots. "Silver Star" starch, 42s. to 43s.

Soap and Candles.—Soap: Signal, 27s.; Burford's Magic, 25s.; No. 1, 25s.; Plain Magic, 18s.; Household, 14s.; Sunlight, 1 to 9 cases, 17s.; 10 cases, 16s. 9d. Lifebuoy, 1 to 9 cases, 12s. 6d.; 10 cases, 12s. 3d. Monkey, 1 to 9 cases, 19s.; 10 cases, 18s. 9d. Candles: Eagle, Exhibition, or Sphinx, 6¼d.; Apollo, Lion, or Globe, 6d.; Electric or National, 5½d.; Family, 5½d.; Mosque, wax 4⅝d.; for 25-box lots of either, ⅛d. less. Imported, D.R.J., 6⅝d.

Preserved Milk.—Nestle's rates: 1 to 9 cases, 26s.; 10 to 24 do., 25s. 10d.; 25 do and upwards, 25s. 8d., all f.o.r. Fremantle. "Sledge," unsweetened and sterilised, 6s. to 5s. 10½d. Ideal, 6s. 3d. Gold Medal, 22s. 6d.; 10 case lots, 22s. 1d.; and 25 case lots, 21s. 9d.; First Swiss, unsweetened, 6s.; Milkmaid, 23s. per case; "Empire," 22s. per case; Fussell's White Butterfly, unsweetened, 5s. 7½d. to 5s. 10½d.; Highlander (N.Z.), case lots 5s. 7½d.; larger quantities, lower rates; Cow's Head, unsweetened, 5s. 10½d. Dahl's Norwegian Cream, small tins 8s., large do. 13s.; Banquet, 12oz., 14s.; 6oz., 8s. "Cupid," 6oz., 7s. 6d. Fussell's Golden Butterfly ½s. 7s. 6d., 1's 11s. 6d. "Violet" brand, 5s.

Salt.—Castle, extra fine, 1cwt. bags, 3s. 3d.; ½-ton lots at £3 2s. 6d.; ton lots, £3 1s. 6d. trucks Fremantle.

Liquors.—Except where stated otherwise, rates are for wines, ale, stout, and spirits in bond. Brandy: Jules Robin and Co., 32s. to 48s.; bulk (in octaves), 7s. per gallon. Rum: Battleaxe, 26s.; Port Royal, 18s. Whisky: Bulk, Bailie Nicol Jarvie, 10s. 6d.; Macleay, Duff's, 10s. 6d.; Glenfalloch, 9s.; other brands, 8s. to 6s.; bottled, Aniolie's "Glenlion," 20s.; Foster's "Bugle," 16s.; Bailie Nicol Jarvie, 21s. 6d.: Macleay Duff's, 23s. 6d.; Usher's, 51s. 6d. to 50s. (duty paid), according to quantity; other brands, 24s. 6d. to 17s. 6d. per case. Gin: Old Tom, 14s.; dry, 1s4.; Melrose-

Drover's Dry or Old Tom, 12s. 9d. Geneva: "Key," 15s. 6d. Schnapps: "Sparrow," 12s. Wines: Robertson Bros. and Co., port, bottled, 30s. to 16s.; bulk, 8s. per gallon; new shipment, 6 or 7 grade, bulk, 8s. to 20s. per gallon. Sherry: Bottled, 22s. to 16s. 6d.; bulk, 8s. per gallon; new shipment (Robertson's), bulk, 8s. to 20s. per gallon. Champagne (duty paid): Henri Frere's, qts., £3; pts., £3 12s. 6d.; babies, £3 17s. 6d. Ale: Pelican, qts., 6s. 6d.; Boar's Head, qts. 7s., qts. 11s. (duty paid). Stout: (Boar's Head), qts. 8s., pts. (duty paid), 7s. 6d. Foster,s "Bugle," qts. 11s. 3d., pts. 7s. 6d. (duty paid). Lager: Qts. (duty paid), 11s. 6d. Cordials: Limejuice, Montserrat, 27s.; Ross, 15s. 6d.; ship's, 14s.; Stower's, 14s. 6d. Table waters: Rosbach, 4s. 3d.; Schweppe's aerated waters, 6s. 3d. to 4s. Mandarin bitters, 35s. per case. Pioneer orange phosphates, No. 1, 11s.; No. 2, 16s.

Kerosene.—On spot, 10⅝d. ex store; quotation ex ship withdrawn.

Metals (Perth).—Iron: Bar from £9 10s.; sheet, £12 15s. to £11 15s.; corrugated, orb, £17 2s. 6d. to £18 5s.; other brands, £17 10s. to £18. Iron wire: Barbed, £16 10s., galvanised fencing, £9 10s. to £10 5s., according to gauge; black No. 8, £8 2s. 6d. to £8 10s. Lead: Sheet, £18 10s.; pig, £17. Zinc: Sheet, £30.

Building Materials (Perth).—Cement, from 12s. 6d., according to brand. Tiles, Marseilles, 50s. per square, or £12 10s. per 1,000.

Timber.—Deals: Baltic, 11s. 6d. to 7s. 6d.; red, 8½d. per foot; sugar, 41s. 8d. oregon, from 16s. 8d.; kauri, 33s. 4d.; jarrah, from 12s.

Quicksilver (Perth), £9 10s.

White Lead (Perth), £30.

Oils, etc. (Perth).—Linseed, boiled, 3s.; naphtha, 1s. 4d.; benzine, 1s.; turpentine, on spot, 4s. 4½d.

MESSRS. PIESSE, LOW, & CO.'S REPORT.

Messrs. Piesse, Lowe, and Co., Ltd., report:—Fruit: Fair supplies of oranges, loquats, and lemons to hand. Best oranges, 12s. 3d. to 15s.; medium, 10s. upwards Lemons, best, 7s. 6d. to 10s. 6d.; others, from 6s. upwards. Loquats, medium, 7s. 6d. to 10s. 6d.; better, 12s. to 15s. Cape gooseberries, 4d. to 4½d. Strawberries, best, to 13s. per doz.; inferior, from 7s. upwards. Vegetables: Our rooms were absolutely filled with all seasonable lines. Cabbage experienced a sharp decline, due to the heavy quantities to hand. Best made 7s. 6d. to 11d. 9d.; other, from 4s. upwards. New potatoes: Heavy supplies to hand, and prices eased on late values. Best, 14s. 6d. to 16s. 3d.; others, from 10s. upwards. Swedes, best, £7 10s. to £9; others, £3 to £5. Pumpkins, £7 10s. to £10. Peas, best, 2d. to 2¾d.; inferior and others, from 1d. upwards. French beans, 4d. to 5¼d. Broad beans, ½d. to 1¼d. Rhubarb, prime, 1¾d. to 2½d.; others, ½d. to 1d. Carrots, best, 1s. to 1s. 9d.; others, from 6d. upwards. Parsnips, 1s. to 1s. 8d. Turnips, best, from 5d. to 8d.; others, from 3d. upwards. Beetroot, 1s. to 1s. 9d. Spinach, 1s. 6d. to 3s. Silver-skin onions, 18s. to 21s.; brown globes, 20s. to 23s. Lettuce, 6d. to 9d. per bag for best; others, from 3d. upwards. Salads, at late market rates. Tomatoes, prime, 19s. 6d. to 22s.; medium, 14s. to 17s. 6d. Poultry: Fair supplies to hand, and bidding was very keen for all prime lots. Best fowls, 6s. to 7s. 6d. per pair; medium, 4s. 6d. to 5s. 9d. Ducks, best, 5s. 6d. to 6s. 3d. Prime lines of Muscovies, up to 10s. 3d. Chickens, 1s. 4d. Eggs: Very heavy supplies to hand; 11½d. to 1s. 2½d.

PERTH FRUIT AND PRODUCE EXCHANGE REPORT.

The Perth Fruit and Produce Exchange report:—As usual, our week-end sale was well attended. The bidding for all lines was very brisk, and prices keep very firm. Fruit is very scarce, and buyers are anxiously waiting for cherries and stone fruits, which we hope to have at the end of next week. Prime local oranges, 13s. to 14s. 6d.; medium, from 10s.; imported, 14s. to 15s.; crates, 24s. to 25s. Local lemons: Prime, 7s. 6d. to 10s. 6d; medium, 5s. to 6s.; inferior, large-sized, 3s. to 5s.; imported, 7s. 6d. to 9s. Imported apples very scarce. Sturmers, 13s. to 14s.; Stone Pippins, 13s. to 13s. 6d.; Crabs, 12s. 6d.; coloured lines scarce, worth 14s. to 15s. Cape gooseberries, 3½d. to 4d. Passion fruit, 18s. to 20s. Loquats, 12s. to 16s. 6d.; small cases, 8s. to 9s. Bananas, 17s. to 18s.; medium, 10s. to 13s.; inferior, 5s. to 8s. English gooseberries, 10s. to 10s. 6d. Heavy supplies of vegetables forward, consisting largely of

peas and potatoes. Demand all round good, and prices firm. Tomatoes firm at 8s. to 10s. to 14s., different sizes. Prime cabbage, 10s. to 15s.; medium, 8s. cwt.; inferior lines, 3s. to 7s. 6d. a bag. Cauliflowers, inferior, 2s. to 4s. to 6s. doz. Carrots, 1s. 3d. to 1s. 9d. Parsnips, 1s. 6d. to 2s. Turnips, 6d. to 1s. Beetroot, 1s. to 1s. 10d. Spinach, 9d. to 1s. 3d. Chinese turnips, 1s. to 1s. 6d. Swedes, 1s. 6d. to 2s. 3d. doz.; loose, 9s. to 10s. 3d. cwt. Ironbark pumpkins, 10s. to 12s. 3d.; bugles, 11s. 6d. Marrows, 2s. to 3s. 3d. Cucumbers, 2s. to 4s. French beans, 4d. to 5d. Broad beans, ½d. to 1¼d. Peas, 1d. to 2½d. Celery, 6d. to 1s. Lettuce, 6d. to 1s. 6d. bag. Parsley, mint, and water-cress, 1s. to 1s. 6d. Herbs, 1s. to 1s. 9d. case. Rhubarb, 1¼d. to 2d. Garlic and horse-radish, 7d. Local potatoes, prime, in small lots, 16s. to 17s.; others, 15s.; medium, 13s. to 14s.; small samples, 5s. to 8s. Local onions, silver-skins, 16s. to 20s. 6d.; globes, 18s. to 21s. 6d. Fresh-laid eggs, 1s. to 1s. 3d.; country lots, from 1s.; duck eggs, fresh, 1s. 4d.; inferior, 9d. Fresh butter, 1s. 1d. to 1s. 3½d. Poultry—Moderately supplied. Ducks, 4s. to 5s. to 6s. 6d. Fowls, 3s. to 5s. to 6s. 6d. Pigeons, 1s. 9d. to 2s. pair.

MESSRS. H. J. WIGMORE & CO.'S REPORT.

Messrs. H. J. Wigmore & Co., of Fremantle, Kalgoorlie, and Northam, report as follows in connection with their daily auction sales of Chaff and Grain at Perth and Fremantle Railway Yards for month ending 7th inst:—

Chaff.—The advent of new season's Chaff, which has now been arriving freely at Perth Yards for the past three weeks, and is every day increasing in supply, has had a detrimental effect on prices, which have slumped considerably. A fortnight ago Prime Green Wheaten Chaff could easily be sold at anything from £6 5s. to £6 10s. per ton. At the present moment £5 10s. is the highest possible price obtainable, and it has even dropped as low as £5 2s. 6d. Agents have been experiencing very heavy yardings during the past fortnight, and if these continue we anticipate even lower prices ruling. We are advised, however, that the rains we have had here lately have reached well into the country, and if this is the case, deliveries may slacken off somewhat for a few days, when there is no doubt that the market will quickly regain its firm tone. A fair quantity of the new season's Chaff has been arriving in a damaged condition, and we must point out to producers generally the advisability of seeing that their Hay is well cured before cutting. There is now practically no old season's Chaff arriving for auction, and we feel confident in reporting that there cannot be much of last season's Chaff carried over, if any at all. This bears out what we have contended for the past six months, and demonstrates clearly that we have been able to advise our clients from time to time very accurately. We are always on the *qui vive* for information as to future prospects, and would suggest to our clients that they keep us fully posted from time to time as to the position of crops in their particular district. By the accumulation of opinions we can naturally give reliable information, which we are always pleased to do. We may say that, as regards Northam and districts, a letter addressed to our office at Northam will be promptly attended to by our representative there. We quote closing values as follow:—Prime Green Wheaten, £5 5s. f.a.q.; Wheaten, £4 15s. to £5 2s. 6d. f.a.q.; Oaten, £4 15s.; medium and inferior grades from £3 upwards, according to quality and condition. The above prices are only an indication of present market, and we do not think they will hold long if Chaff continues to arrive in such large quantities as at present. With light yardings, they will probably hold for a week or two.

Wheat.—This commodity has not improved in value, although a few small parcels have reached 4s. 4d. at auction. Truck lots, however, are nominally worth 4s. 3d. We have made considerable sales privately during the month on the basis of 4s. and 4s. 0½d., country stations.

Straw.—Has been in limited supply, and we sold one truck last week at £4, this being the highest price for the season. Since then it has been sold down to £3, which may be quoted present value.

Flour.—We have to report advance in price of Thomas' Adelaide Standard, which is now quoted at £8 5s. and £8 10s. for sacks and quarters respectively, f.o.b. Port Adelaide. This advance is probably due to the complications that have arisen in Russia, and there is no knowing to what extent prices may yet go, and the market is particularly firm. We have made very heavy sales this week of Thomas & Co's. Northam Standard on the basis of £8 10s., sacks on rails, Northam, for forward delivery. For prompt delivery we quote £8 5s. sacks, £8 10s. quarters.

Oats.—Have advanced in Victoria, and are now worth 2s. 4d. f.o.b. for prime milling Algerians. We learn from Victoria that the weather is still most unseasonable and cold, and that all crops will be at least three weeks late. Value on spot are whole 2s. 9d., crushed 2s. 10d.

Bran and Pollard—Still continue firm in the Eastern States, Adelaide quoting 1s. to 1s. 1d. for the former and 1s. 3d. for the latter. Melbourne is steady at 11d. for Bran and 1s. 2d. for Pollard, and Sydney is nominally 11½d. Bran and 1s. 6d. Pollard. On spot sales are with difficulty being made at £7 15s., Perth. Ex the *Kanowna* we understand £7 5s., Fremantle, has been accepted.

KALGOORLIE CHAFF MARKET.

Our Kalgoorlie office reports that supplies have been light, and at time of writing market is firm at £6 10s. for prime new season's green Wheaten Chaff. Sales have been made for this centre on the basis of £4 5s., Northam, for forward delivery, and as soon as these supplies come to hand, undoubtedly the market will ease in sympathy. Consignments to our Kalgoorlie Branch will always receive the same prompt attention as is the case with Perth and Fremantle. Producers will please note that there is greater difficulty in disposing of inferior Chaff on the Fields than at Perth or Fremantle, and we strongly advise only very best quality going to the goldfields.

THE CLIMATE OF WESTERN AUSTRALIA DURING OCTOBER, 1905.

There were two noticeable disturbances during the month. On the 7th and 8th a "low" passed in a south-east direction across the South-West corner of the State, giving heavy rains along the Great Southern Railway, but only a few light showers on the extreme South-West coast. Again a "low" passed across the State, in a track a little farther east than the former, on the 18th and 21st. This was unaccompanied by severe weather of any sort, but was followed almost immediately by an ordinary winter "low" passing along the Southern ocean and bringing heavy rain throughout South-West districts.

On the whole, the rainfall for the month was slightly below the average for previous years, except in those portions of the Southern districts visited by the heavy downpour of the 8th. Little or no rain fell north of latitude 28°.

Pressure was, on the whole, above the average for previous years, the excess gradually increasing from *nil* in the tropics to nearly two-tenths of an inch in the extreme South and South-East.

Temperature was above normal on West coastal districts, but below inland. From the limited information at our disposal, it appears that the moderately high day temperatures on the West coast are an exception to the whole of the southern half of Australia. On the Murchison and Coolgardie fields the thermometer readings were decidedly lower than the means for previous years; and, judging by the figures for Adelaide, Melbourne, and Sydney, it was unusually cold throughout the Eastern States, the amounts of the mean maximum below normal at those places being respectively 8°·4, 7°·1, and 4°·0.

The Climate of Western Australia during October, 1905.

Locality.	Barometer (corrected and reduced to sea-level).				Shade Temperatures.									Rainfall.		
					October, 1905.					Average for previous Years.						
	Mean of 9 a.m. and 3 p.m.	Average for previous years.	Highest for Month.	Lowest for Month.	Mean Max.	Mean Min.	Mean of Month.	Highest Max.	Lowest Min.	Mean Max.	Mean Min.	Highest ever recorded.	Lowest ever recorded.	Points (100 to inch) in Month.	Wet Days.	Total Points since Jan. 1.
North-West and North Coast:																
Wyndham	29·912	29·900	30·096	...	99·5	80·2	89·8	109·2	73·0	98·1	79·1	110·2	68·5	34	3	1,115
Derby	29·906	29·917	30·059	29·744	98·6	70·6	84·6	104·0	62·1	96·7	70·9	112·2	58·6	*Nil*	...	1,482
Broome	29·934	29·926	30·082	29·807	90·0	70·6	80·3	103·8	69·4	90·7	70·2	108·6	52·8	*Nil*	...	694
Condon	29·937	29·945	30·085	29·770	88·3	61·7	75·0	99·5	49·8	90·7	61·4	108·2	49·0	*Nil*	...	796
Cossack	29·948	29·956	30·092	29·773	89·9	64·6	77·2	100·0	59·0	92·4	65·2	110·5	56·0	*Nil*	...	763
Onslow	29·982	29·970	30·101	29·823	86·3	59·2	72·8	98·4	53·4	88·7	59·9	108·5	48·5	*Nil*	...	607
Winning Pool ...	...	...	...	...	...	...	...	...	...	...	...	...	...	*Nil*	...	843
Carnarvon	...	30·034	...	...	80·1	62·6	71·4	100·0	51·0	78·0	60·4	100·6	46·2	*Nil*	...	1,032
Hamelin Pool... ...	29 984	30·018	30·198	29·814	83·9	56·3	70·1	96·2	44·8	81·5	54·8	101·6	44·6	9	2	754
Geraldton	30·076	30·061	30·320	29·820	75·0	52·0	63·5	89·0	43·0	72·9	55·3	100·0	43·0	68	5	1,983
Inland:																
Hall's Creek	...	29·928	...	...	...	...	...	...	...	97·7	67·8	108·0	48·4	13	3	...
Marble Bar	...	...	...	...	97·1	66·9	82·0	101·5	55·5	97·2	65·5	107·5	51·2	*Nil*	...	895
Nullagine	29·938	29·925	30·156	29·692	92·6	60·8	71·7	98·5	49·5	94·4	60·5	107·0	43·9	*Nil*	...	577
Peak Hill	29·981	29·959	30·230	29·660	82·6	57·2	69·9	92·0	50·0	84·3	58·5	97·6	41·3	30	2	484
Wiluna	30·003	29·932	30·242	29·600	81·6	54·0	68·8	95·0	42·0	82·4	53·9	98·2	39·1	2	1	540
Cue	30·024	29·994	30·287	29·684	80·9	54·0	67·4	93·8	45·5	82·3	54·8	99·0	41·5	3	1	706
Murgoo	...	...	...	...	81·9	55·4	68·6	92·6	44·2	...	...	...	...	4	1	511
Yalgoo	30·012	30·002	30·321	29·665	80·3	52·5	66·4	95·0	43·0	80·5	52·5	98·6	38·9	15	1	974
Lawlers	30·038	30·003	30·372	29·579	78·9	53·3	66·1	94·2	45·2	81·6	55·2	99·9	41·2	7	4	685
Laverton	30·056	29·988	30·411	29·586	76·8	51·8	64·3	94·1	34·0	80·4	53·2	102·3	39·0	34	2	689
Menzies	30·064	29·978	30·429	29·612	76·0	49·5	62·8	92·2	42·0	79·1	53·3	99·0	39·2	3	3	553
Kanowna	...	...	...	...	73·0	48·4	60·7	89·5	41·0	...	...	...	...	25	3	538
Kalgoorlie	30·074	29·982	30·484	29·616	74·6	48·8	61·7	91·2	40·6	77·7	52·6	97·6	39·8	40	3	529
Coolgardie	30·063	29·984	30·461	29·588	73·2	47·2	60·2	89·6	39·0	77·7	51·1	99·8	38·7	61	5	645
Southern Cross ...	30·082	29·980	30·426	29·571	76·4	45·9	61·2	93·4	36·0	77·3	48·9	97·8	35·0	53	2	629
Kellerberrin	...	...	...	...	...	...	...	...	...	...	...	...	...	33	4	1,156
Walebing	...	...	...	...	72·8	47·3	60·0	92·0	35·8	70·4	46·5	91·9	33·8	69	4	2,042
Northam	...	...	...	...	74·6	45·7	60·2	93·0	37·0	72·5	47·2	92·9	34·7	51	3	1,980
York	30·108	30·024	30·475	29·684	73·1	44·0	58·6	92·0	36·6	73·2	47·0	91·5	31·4	79	4	2,106
Guildford	...	...	...	...	74·0	51·6	62·8	90·0	42·2	72·0	50·6	93·0	40·6	110	6	3,389

The Climate of Western Australia during October, 1905—*continued.*

	Locality.	Barometer (corrected and reduced to sea-level). Mean of 9 a.m. and 3 p.m.	Average for previous years.	Highest for Month.	Lowest for Month.	Shade Temperatures. October, 1905. Mean Max.	Mean Min.	Mean of Month.	Highest Max.	Lowest Min.	Average for previous Years. Mean Max.	Mean Min.	Highest ever recorded.	Lowest ever recorded.	Rainfall. Points (100 to inch) in Month.	Wet Days.	Total Points since Jan. 1.
SOUTH-WEST AND SOUTH COAST:	Perth Gardens	30·123	30·058	30·460	29·690	73·7	51·9	62·8	83·0	45·0	71·4	52·4	97·0	38·0	145	5	3,270
	Perth Observatory ...	30·118	30·042	30·455	29·698	71·1	51·6	61·4	84·2	44·9	68·9	53·2	89·8	41·2	158	5	3,315
	Fremantle	30·144	30·031	30·484	29·746	69·3	53·5	61·4	83·5	46·0	67·4	55·7	87·0	41·6	116	3	2,633
	Rottnest	30·128	30·019	30·449	29·706	67·9	54·4	61·2	80·0	47·0	67·4	56·3	84·6	43·5	68	3	3,462
	Mandurah	...	...	...	...	71·3	49·2	60·2	87·2	37·3	69·0	49·5	89·3	36·3	206	3	4,090
	Marradong	...	...	...	...	...	...	...	...	...	...	...	...	...	274	4	3,292
	Wandering	...	...	...	...	69·3	41·1	55·2	...	35·0	...	...	...	...	258	3	3,283
	Narrogin	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Collie	...	...	...	...	69·9	42·6	56·2	84·3	32·0	67·7	44·0	88·6	31·2	278	8	3,880
	Donnybrook *	...	...	...	...	69·9	46·2	58·0	83·8	35·8	66·5	47·3	88·7	36·7	286	7	3,981
	Bunbury	30·156	30·034	30·494	29·680	69·1	48·1	58·6	84·0	39·0	68·1	50·9	89·2	37·4	256	6	3,602
	Busselton	...	...	...	...	69·6	46·0	57·8	85·2	37·4	67·4	47·5	85·8	37·2	189	11	2,889
	Cape Naturaliste ...	30·148	...	30·523	29·703	65·1	50·0	57·6	73·5	41·8	...	...	...	...	152	8	2,801
	Bridgetown	...	...	...	...	68·8	41·5	55·2	86·0	31·0	67·8	43·4	86·0	31·2	331	12	3,275
	Karridale	30·164	30·021	30·499	29·705	65·4	46·7	56·0	72·4	35·1	65·7	50·1	85·2	36·8	164	11	4,253
	Cape Leeuwin	30·126	29·982	30·491	29·614	64·0	53·9	59·0	71·9	47·3	64·3	54·9	82·8	44·8	193	16	3,653
	Katanning	30·126	29·998	30·531	29·679	67·2	43·8	55·5	85·0	36·0	68·3	45·8	87·0	31·0	388	9	2,222
	Mt. Barker	...	...	...	...	63·3	44·8	54·0	73·5	37·0	...	...	...	...	457	10	2,822
	Albany	30·163	29·985	30·560	29·680	63·4	49·7	56·6	80·0	39·9	65·3	49·4	83·0	36·2	514	13	3,684
	Breaksea...	30·155	29·981	30·560	29·560	60·0	51·0	55·5	70·0	45·0	61·8	52·0	78·0	39·0	414	14	3,449
	Esperance	30·101	29·992	30·546	29·525	66·9	47·8	57·4	85·0	37·5	69·3	51·2	101·4	36·2	86	10	2,285
	Balladonia	30·123	29·998	30·550	29·609	70·9	45·1	58·0	89·8	35·7	74·0	48·1	98·0	35·8	67	3	595
	Eyre	30·197	30·013	30·467	29·535	68·8	48·2	58·5	86·9	29·2	72·0	51·2	95·5	30·0	11	4	670
	INTERSTATE.																
	Perth	30·118	30·042	30·455	29·698	71·1	51·6	61·4	84·2	44·9	68·9	53·2	89·8	41·2	158	5	3,315
	Adelaide	30·035	30·021	30·418	29·585	64·3	46·1	55·2	77·0	38·9	72·7	51·4	100·5	36·0	290	18	2,227
	Melbourne	29·945	29·883	30·415	29·456	59·9	45·5	52·7	72·0	36·0	67·0	48·1	96·1	32·1	257	18	2,358
	Sydney	29·920	30·001	30·400	29·380	67·0	51·0	59·0	85·0	44·0	71·0	55·9	99·7	43·3	231	13	3,167

* Averages for three years only.

The Observatory, Perth, 9th October, 1905.

W. E. COOKE, Government Astronomer.

RAINFALL for September, 1905 (completed as far as possible), and for October, 1905 (principally from Telegraphic Reports).

Stations.	September. No. of points. 100 = 1in.	September. No. of wet days.	October. No. of points. 100 = 1in.	October. No. of wet days.
East Kimberley:				
Wyndham	Nil	...	32	3
6-Mile	...	...	...	...
The Stud Station	...	...	...	...
Carlton	Nil	...	...	...
Denham	...	...	...	...
Rosewood Downs	Nil	...	...	...
Argyle Downs	...	...	...	...
Lisadell	...	...	..	...
Turkey Creek	9	1	12	2
Ord River	...	...	...	...
Alice Downs	Nil	...	...	...
Hall's Creek	13	1	13	3
Nicholson Plains	...	...	...	...
Flora Valley	...	...	...	...
Ruby Plains	...	...	...	...
Denison Downs	...	...	...	...
West Kimberley:				
Obagama	Nil	...	...	...
Beagle Bay	...	...	...	...
Pt. Torment	Nil	...	...	...
Derby	7	1	Nil	...
Yeeda	...	...	...	...
Liveringa	...	...	...	...
Mt. Anderson	...	...	...	...
Leopold Downs	Nil	...	...	...
Fitzroy Crossing	Nil	...	Nil	...
Fitzroy (C. Blythe)	Nil	...	...	...
Quanbun	25	1	...	...
Nookanbah	...	...	...	...
Broome	81	1	Nil	...
Roebuck Downs	20	1	...	...
Thangoo	...	...	...	...
La Grange Bay	51	4	Nil	...
North-West:				
Wallal	64	3	Nil	...
Condon	41	1	Nil	...
Pardoo	28	1	..	...
DeGrey River	45	1	...	...
North-West—*cont.*				
Port Hedland	37	1	1	1
Boodarie	...	...	...	...
Warralong	21	1	...	...
Muccan	...	...	...	...
Ettrick	...	...	...	...
Mulgie	...	...	...	...
Eel Creek	...	...	...	...
Station Peak	Nil	...	...	...
Coongon	18	1	...	...
Warrawagine	70	1	...	...
Bamboo Creek	18	2	Nil	...
Marble Bar	4	2	Nil	...
Warrawoona	1	1	Nil	...
Corunna Downs	...	...	...	...
Nullagine	Nil	...	Nil	...
Mt. Edgar	...	...	...	...
Kerdiadary	Nil	...	...	...
Roy Hill	...	...	...	...
Middle Creek	Nil	...	...	...
Mosquito Creek	...	...	...	...
Mulga Downs	Nil	...	...	...
Woodstock	Nil	...	...	...
Mt. Florence	Nil	...	...	...
Tambrey	Nil	...	...	...
Millstream	...	...	...	...
Yandyarra	...	...	...	...
Mallina	Nil	...	...	...
Whim Creek	5	1	Nil	...
Cooyapooya	...	...	...	...
Woodbrooke	...	...	...	...
Croydon	Nil	...	...	...
Balla Balla	...	...	...	...
Roebourne	1	1	Nil	...
Cossack	Nil	...	Nil	...
Sherlock	Nil	...	...	...
Fortescue	Nil	...	...	...
Mardie	Nil	...	...	...
Mt. Stewart	...	...	...	...
Yarraloola	...	...	...	...
Chinginarra	Nil	...	...	...
Onslow	Nil	...	...	...
Peedamullah	Nil	...	...	...
Red Hill	...	...	...	...
Mt. Mortimer	...	...	...	...
Peake Station	Nil	...	...	...
Wogoola	...	...	...	...

RAINFALL—*continued.*

Stations.	September. No. of points. 100 = 1in.	September. No. of wet days.	October. No. of points. 100 = 1in.	October. No. of wet days.
North-West—*cont.*				
Nanutarra ...	...	...	...	...
Yanrey ...	Nil	...	...	...
Point Cloates ...	...	...	...	...
Edmunds ...	17	3	...	...
Gascoyne:				
Winning Pool ...	5	1	Nil	...
Coordalia ...	...	...	...	...
Towara ...	Nil	...	...	...
Ullawarra ...	...	...	...	...
Maroonah ...	...	...	...	...
Gifford Creek ...	...	...	...	...
Bangemall ...	...	...	...	...
Mt. Augustus ...	...	...	...	...
Minnie Creek ...	6	2	...	...
Yanyeareddy ...	...	...	...	...
Williambury ...	9	1	...	...
Booloogooroo ...	...	...	...	...
Wandagee ...	...	...	...	...
Bernier Island ...	...	...	...	...
Boolathana ...	59	4	...	...
Carnarvon ...	30	4	Nil	...
Brick House ...	...	...	...	...
Doorawarrah ...	...	...	...	...
Bintholya ...	...	...	...	...
Mungarrah ...	Nil	...	...	...
Clifton Downs ...	...	...	...	...
Dairy Creek ...	15	2	...	...
Upper Clifton Downs	...	...	...	...
Dirk Hartog Island	230	11	...	...
Sharks Bay ...	25	6	8	1
Kararang ...	147	11	...	...
Meedo	26	6	...	...
Tamala	...	...	...	...
Wooramel ...	77	4	15	2
Hamelin Pool ...	62	8	9	2
Byro	...	...	Nil	...
Yarra Yarra ...	27	4	Nil	...
Berringarra ...	...	...	...	...
Mt. Gould ...	...	...	...	...
Moorarie ...	3	1	14	2
Wandary ...	...	...	...	...
Peak Hill ...	12	2	30	2
Mt. Fraser ...	...	...	...	...
Abbotts	Nil	...	...	...
Belele	...	...	...	...

Stations.	September. No. of points. 100 = 1in.	September. No. of wet days.	October. No. of points. 100 = 1in.	October. No. of wet days.
Gascoyne—*contd.*				
Mileura	7	1	...	...
Milly Milly ...	16	3	...	...
Manfred ...	31	4	4	3
New Forest ...	...	...	...	...
Woogorong ...	52	6	Nil	...
Boolardy ...	28	2	...	...
Twin Peaks ...	...	...	...	...
Billabalong ...	60	3	Nil	...
Wooleane ...	81	6	...	...
Woolgorong ...	65	2	3	2
Murgoo	45	4	4	1
Yallalonga ...	104	6	...	...
Meka	32	3	...	...
Mt. Wittenoom ...	39	3	...	...
Nannine	20	3	7	1
Star of the East...	...	...	Nil	...
Annean	...	...	...	...
Tuckanarrra ...	18	3	...	...
Coodardy ...	20	1	Nil	...
Cue	48	5	3	1
Day Dawn ...	28	3	Nil	...
Lake Austin ...	49	2	4	2
Lennonville ...	48	5	5	2
Mt. Magnet ...	39	4	4	2
Challa	54	4	Nil	...
Youeragabbie ...	37	2	...	...
Black Range ...	19	2	28	2
Murrum	...	...	...	...
Burnerbinmah ...	56	6	...	...
Barnong	123	6	Nil	...
Mellenbye ...	135	9	...	...
Yalgoo	135	7	15	1
Wagga Wagga ...	106	6	...	...
Gabyon	94	4	...	...
Tallyrong ...	...	...	...	...
Gullewa	128	6	...	...
Muralgarra ...	106	5	...	...
Wydgee	78	6	...	...
Wearagaminda...	148	7	16	2
Gullewa House ...	151	12	12	3
South-West Division (Northern Part):				
Murchison House	374	10	...	...
Mt. View ...	272	8	...	...
Mumby	455	14	60	5

RAINFALL—*continued.*

Stations.	September. No. of points. 100 = 1in.	September. No. of wet days.	October. No. of points. 100 = 1in.	October. No. of wet days.
South-West (Northern)—*contd.*				
Yuin	122	4	19	1
Northampton ...	661	13	109	5
Oakabella ...	...	...	...	...
Narra Tarra ...	531	8	...	...
Tibradden ...	490	15	121	6
Myaree	457	12	...	...
Sand Springs ...	352	9	98	3
Mullewa... ...	251	14	22	3
Chapman Experimental Farm...	425	13	93	3
Kockatea ...	254	9	57	3
Bootenal ...	255	...	...	...
Geraldton ...	318	15	68	5
White Peak ...	474	10	...	...
Greenough ...	313	13	83	4
Bokara	350	15	85	4
Dongara ...	344	13	42	3
Brookman's Hills	194	8	37	3
Strawberry ...	374	15	...	...
Nangetty ...	...	...	...	...
Mingenew ...	272	15	37	4
Urella	219	13	...	...
Yandenooka ...	336	11	...	...
Rothesay ...	...	...	...	...
Ninghan... ...	141	5	...	...
Condingnow ...	...	...	...	...
Field's Find ...	84	7	...	...
Carnamah ...	286	11	28	4
Watheroo ...	270	14	...	...
Nergaminon ...	...	...	53	3
Dandaragan ...	561	13	102	4
Moora	366	11	31	2
Yatheroo ...	...	...	...	...
Walebing ...	470	14	69	4
Round Hill ...	437	13	60	4
New Norcia ...	405	15	59	3
Wannamel ...	487	12	52	3
South-Western Division, Central (Coastal):				
Gingin	589	10	62	3
Belvoir	699	14	91	4
Mundaring ...	887	13	183	4
Wandu	658	16	120	6
Guildford ...	681	14	110	6
Kalbyamba ...	588	12	166	5
Canning W't'r'w'ks	752	14	170	4
Perth Gardens ...	594	14	145	5

Stations.	September. No. of points. 100 = 1in.	September. No. of wet days.	October. No. of points. 100 = 1in.	October. No. of wet days.
South-West (Coastal)—*contd.*				
Perth Observatory	575	14	158	5
Highgate Hill ...	500	13	...	...
Subiaco	552	14	150	4
Claremont ...	...	...	...	...
Wanneroo ...	692	13	122	3
Jandakot ...	685	13	238	3
Fremantle ...	491	15	116	3
Rottnest... ...	405	15	68	3
Armadale ...	460	15	208	3
Rockingham ...	426	12	174	3
Mundijong ...	...	...	180	4
Jarrahdale (Norie)	824	15	252	5
Jarrahdale ...	908	15	311	5
Serpentine ...	750	15	233	6
Mandurah ...	735	12	206	3
Pinjarra (Blythewood)	695	15	197	5
Pinjarra	617	13	201	4
Yarloop	840	15	...	...
Harvey	878	16	248	15
Upper Murray ...	831	14	312	6
South-West, Central Part (Inland):				
Hatherley ...	274	10	...	...
Dowerin ...	355	12	...	...
Momberkine ...	256	8	...	...
Monglin... ...	...	...	...	...
Warramuggin ...	249	16	...	...
Newcastle ...	450	13	75	2
Emungan ...	373	15	32	5
Eumalga ...	581	12	...	...
Eadine	614	13	39	2
Northam ...	481	14	51	3
Grass Valley ...	369	12	...	...
Meckering ...	243	9	43	4
Cunderdin ...	357	14	...	...
Codg-Codgen ...	251	12	...	...
Yarragin ...	285	11	...	...
Doongin... ...	244	12	...	...
Cuttenning ...	224	11	...	...
Whitehaven ...	...	...	...	...
Cardonia ...	241	12	...	...
Sunset Hills ...	405	12	103	5
Jelcobine ...	587	14	211	6
Cobham	490	14	83	6
Yenelin	...	...	...	...
Mt. Caroline ...	278	7	16	3

RAINFALL—*continued.*

Stations.	September. No. of points. 100 = 1in.	September. No. of wet days.	October. No. of points. 100 = 1in.	October. No. of wet days.	Stations.	September. No. of points. 100 = 1in.	September. No. of wet days.	October. No. of points. 100 = 1in.	October. No. of wet days.
South-West (Central)—*contd.*					South-West—(Southern)—*cont.*				
York	449	12	79	4	Mordalup ...	584	13	250	8
Dalebridge ...	364	10	115	4	Deeside	575	15	254	10
Beverley ...	450	9	137	3	Riverside ...	598	13	...	...
Bally Bally ...	422	12	109	5	Balbarup ...	569	11	280	10
Oakdale	469	14	...	...	Wilgarup ...	710	14	375	15
Barrington ...	334	11	85	5	Cundinup ...	446	13	...	...
Qualin	305	9	...	...	Bridgetown ...	695	17	331	12
Stock Hill ...	286	10	161	4	Westbourne ...	525	15	295	11
Sunning Hill ...	582	13	153	5	Hilton	513	8	...	...
Brookton ...	409	10	117	3	Greenbushes ...	885	11	397	7
Wandering ...	757	10	258	3	Greenfields ...	614	13	271	8
Glen Ern ...	544	13	200	7	Glenorchy ...	298	8	283	7
Pingelly ...	521	10	141	4	Williams ...	458	11	215	6
Yornan	498	14	150	5	Arthur	466	9	190	6
Marradong ...	628	11	294	4	Rifle Downs ...	492	12	...	...
Crooked Pool ...	421	13	183	8	Darkan	490	10	...	...
Bannister ...	...	...	...	...	Wagin	504	11	82	3
Wounaminta ...	450	15	...	...	Glencove ...	398	11	300	7
Narrogin ...	420	12	203	7	Dyliabing ...	400	14	...	...
Narrogin State Farm					Katanning ...	384	11	388	9
	...	...	...	...	Kojonup ...	618	11	447	11
Wickepin ...	470	14	...	...	Broomehill ...	409	12	271	10
Gillimaning ...	416	11	...	...	Woolganup ...	384	11	366	9
Bunking ...	381	9	...	...	Sunnyside ...	427	14	334	8
Bullock Hills ...	353	11	...	...	Talbot House ...	417	10	...	...
Berringarra ...	...	...	...	...	Woodyarrup ...	361	13	...	...
					Miauelup ...	286	14	...	...
					Cranbrook ...	355	12	...	...
					Toolbrunup ...	360	14	360	7
South-West Division (Southern Part):					Tambellup ...	274	14	510	9
					Blackwattle ...	251	7	...	...
					Woogenellup ...	370	17	402	10
Bunbury ...	679	15	256	6	Mt. Barker ...	608	22	457	10
Brunswick ...	467	9	247	3	Kendenup ...	554	16	411	12
Collie	873	16	278	8	St. Werburgh's...	479	17	...	...
Glen Mervyn ...	640	12	301	5	Forest Hill ...	...	...	641	14
Donnybrook ...	671	13	286	7	Wilson's Inlet ...	546	18	564	14
Boyanup ...	633	10	258	4	Grasmere ...	688	20	456	15
Ferndale ...	409	10	343	9	Albany	796	21	514	13
Busselton ...	552	16	189	11	King River ...	628	17	573	12
Quindalup ...	380	16	179	9	Point King ...	722	19	300	11
Cape Naturaliste	346	13	152	8	Breaksea ...	748	20	414	14
Glen Lossie ...	417	13	239	9	Wattle Hill ...	...	...	485	16
Lower Blackwood	622	13	200	9	Cape Riche ...	409	12	469	8
Karridale ...	722	19	164	11	Cherilaluup ...	408	11	...	...
Cape Leeuwin ...	533	19	193	16	Pallinup... ...	360	13	329	
Biddellia ...	408	11	...	...	Bremer Bay ...	472	16	443	127
The Warren ...	437	13	191	13	Peppermint Grove	464	17	536	11
Lake Muir ...	611	16	280	9	Jarramongup ...	...	...	...	...
The Peninsula ...	...	...	...	...	Chillinup ...	306	16	300	9

RAINFALL—*continued.*

Stations.	September. No. of points. 100 = 1in.	September. No. of wet days.	October. No. of points. 100 = 1in.	October. No. of wet days.
Eastern Division:				
Dural	2	1	...	...
Wiluna	3	2	2	1
Gum Creek ...	Nil	...	Nil	...
Mt. Sir Samuel ...	Nil	...	18	2
Lawlers	8	5	7	4
Leinster G.M. ...	Nil	...	...	...
Darda	...	...	...	...
Lake Darlôt ...	...	...	...	...
Duketon ...	...	...	...	...
Salt Soak ...	4	1	29	3
Mt. Leonora ...	20	3	37	3
Mt. Malcolm ...	10	1	35	2
Mt. Morgans ...	Nil	...	66	3
Burtville ...	...	...	...	...
Laverton ...	Nil	...	34	2
Murrin Murrin ...	Nil	...	56	2
Yundamindera ...	2	1	29	2
Tampa	Nil	...	5	1
Kookynie ...	9	2	22	3
Niagara	Nil	...	14	2
Yerilla	5	1	...	...
Quandinnie ...	23	4	...	...
Edjudina ...	6	2	...	...
Menzies	30	2	35	3
Mulline	49	4	22	2
Waverley ...	...	...	...	...
Goongarrie ...	41	4	69	3
Mulwarrie ...	43	4	94	...
Bardoc	19	5	58	3
Broad Arrow ...	45	7	52	3
Kurnalpi ...	34	3	73	4
Bulong	65	5	43	3
Kanowna ...	49	8	25	3
Kalgoorlie ...	41	7	40	...
Coolgardie ...	70	6	61	5
Burbanks ...	79	7	56	...
Woolubar ...	36	4	...	...
Widgiemooltha ...	65	8	61	4
50-Mile Tank ...	111	9	58	6
Waterdale ...	68	7	...	...
Norseman ...	74	7	55	...
Lake View ...	120	11	...	...
Bulla Bulling ...	50	4	52	5
Boondi	61	8	31	4
Boorabbin ...	81	6	27	3
Koorarawalyee ...	122	9	35	3
Karalee	135	5	22	2
Eastern—*contd.*				
Yellowdine ...	86	5	20	1
Southern Cross ...	85	6	53	2
Parker's Range ...	146	14	50	7
Parker's Road ...	138	8	...	...
Mt. Jackson ...	69	5	...	...
Bodallin ...	124	8	...	...
Glen Elg Rocks	232	18	...	...
56-Mile	...	...	49	4
Emu Rocks ...	165	10	...	...
Burracoppin ...	...	...	...	...
Baandee ...	181	7	...	...
Kellerberrin ...	266	11	33	4
Merredin ...	179	10	17	4
Nangeenan ...	206	8	10	1
Mangowine ...	240	13	...	...
Wattoning ...	84	3	...	...
Noongarin ...	...	...	...	...
163-Mile ...	...	...	23	4
126-Mile ...	...	...	25	1
90-Mile ...	...	...	9	1
Eucla Division:				
Ravensthorpe ...	156	10	159	10
Coconarup ...	160	14	165	10
Hopetoun ...	119	8	174	8
Fanny's Cove ...	203	7	...	...
Park Farm ...	182	13	...	...
Esperance ...	308	17	86	10
Gibson's Soak ...	144	16	...	...
30-Mile Condenser	128	12	...	...
Swan Lagoon ...	138	11	...	...
Grass Patch ...	118	7	...	...
Myrup	200	16	125	9
Lynburn ...	195	15	...	...
Boyatup	371	15	...	...
Middle Island ...	91	8	...	...
Point Malcolm ...	287	14	...	...
Israelite Bay ...	313	17	106	11
Balbinia	103	11	...	...
Frazer Range ...	119	5	...	...
Balladonia ...	96	8	67	3
Southern Hills ...	119	3	...	...
Eyre	86	8	11	4
Mundrabillia ...	...	...	...	...
Eucla	52	10	10	6

The Observatory, Perth,
7th November, 1905.

W. E. COOKE,
Government Astronomer.

By Authority: A. Curtis, Acting Government Printer, Perth.

JOURNAL

OF THE

Department of Agriculture

OF

WESTERN AUSTRALIA.

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EDITOR'S NOTES.

PRUNING TOMATOES.—The heaviest yield of fruit may be obtained from plants that in the early stages are nipped, allowing from four to six stems to grow, afterwards nipping all laterals. The plants so treated will give three and four times as much fruit as those not treated.

CARE OF THE ORCHARD.—The result of a large number of experiments just completed on the methods of mulching trees *v.* cultivating the ground, shows conclusively that when the ground has been kept thoroughly cultivated during the summer the yield has been over 50 per cent. more fruit than from those trees protected with mulching only.

BACON FACTORY.—Rapid progress is being made with the buildings for the turning of pork into bacon and hams. Mr. Hutton states that he hopes to be ready for receiving pigs early in February. It is stated that the average pigs bred in this State are not as a rule fit for bacon, by reason of the want of a knowledge of how to feed, or, to use Mr. Hutton's own words, "they are not porkers at all, only forward stores." Pigs like the large black, if properly fed, will make good bacon pigs at a very early age.

THE "JOURNAL."—As some persons have an idea that the *Journal* is being distributed free indiscriminately, it may be as well to again state that this is not so. The *Journal* will be posted free to all those who are settled on the land and are making their living from it. An application form will be found in this and the two previous issues that should be filled up and posted to the Under Secretary. Any other person requiring the *Journal* must forward the sum of five shillings with their application, when the *Journal* will be sent them post free for one year from January 1st next.

Mule Breeding.—There is hardly a week passes but what some work has to be done on a farm that can best be performed by a mule, yet the breeding of these very useful animals is almost totally neglected in this State. On nearly every farm the right sort of mare can be found that would answer the purpose as a mule-breeder. The essentials are a good, stout, roomy mare and an active donkey sire. In mule breeding it must be remembered that mules are bred for strength and endurance and not for speed, so that mares of good bone substance and roomy will be found to throw the best mules.

Codlin Moth Parasite.—It is pleasing to note that the efforts of Mr. G. Compére, the Government Entomologist of this State, have been successful in establishing the codlin moth parasite in California. The San Francisco *California Fruit Grower*, of October 7th, in speaking of the introduction of the parasite, says:—"The insect has made itself at home in California, and the reports received from the various sections of the State to which colonies were sent are very satisfactory. The insects are increasing rapidly, and the greatest confidence is expressed that they will prove to be all that was hoped of them."

Dried *v.* Cured Fruit.—The terms dried and cured, when used in conjunction with fruit, is synonymous to a great many fruitgrowers, yet there is a vast difference. Dried fruit is fruit from which so much of the water has been extracted that it will "keep." It is a very quick process with a drier or in a hot sun. Cured fruit is fruit ripened on the tree and then so handled as to promote and continue as long as possible the chemical changes which produce sugar. This process takes more time and costs more money, but it is the only way to make good fruit which sells well and holds the market, and it is probable that the extra weight secured will fully pay the additional cost of handling.

Purple Scale Parasite.—The San Francisco *Weekly Chronicle* states that "a shipment of two small orange trees infested with purple scale, which were parasitised by a minute unnamed insect, has been received from George Compére, the Government Entomologist of Western Australia, who is in China looking for parasites of that scale. The purple scale has been found the most difficult of all scales to deal with and an effective parasite for it will be heartily welcomed. Mr. Compére is also looking for a parasite of thrips." The parasite referred to, which has not yet been classified, is a minute insect belonging to the family of calcid flies. It is yellow in colour, somewhat resembling the insect which is parasitic on the San José scale.

Fertilisers.—Exhaustive experiments on the denitrification of the soil has led to the following conclusions:—Applications of calcium and sodium nitrates give better results than no nitrate, the calcium nitrate being more effective than the sodium nitrate. Green manures give better results than well-rotted stable manure, the latter better than fresh stable manure,

and fresh stable manure better than straw. The general conclusion, confirming results previously obtained, is that calcium nitrate, a natural product of nitrification, is a better fertiliser than sodium nitrate. The calcium salt, moreover, offers greater resistance to the action of the denitrifying organisms than the sodium salt, denitrification depending mainly upon the character of the organic matter of the manure. The danger from denitrification in the soil may be wholly or partially obviated only when the organic substances have been decomposed, that is, when the denitrifying organisms have been reduced to a state of inactivity.

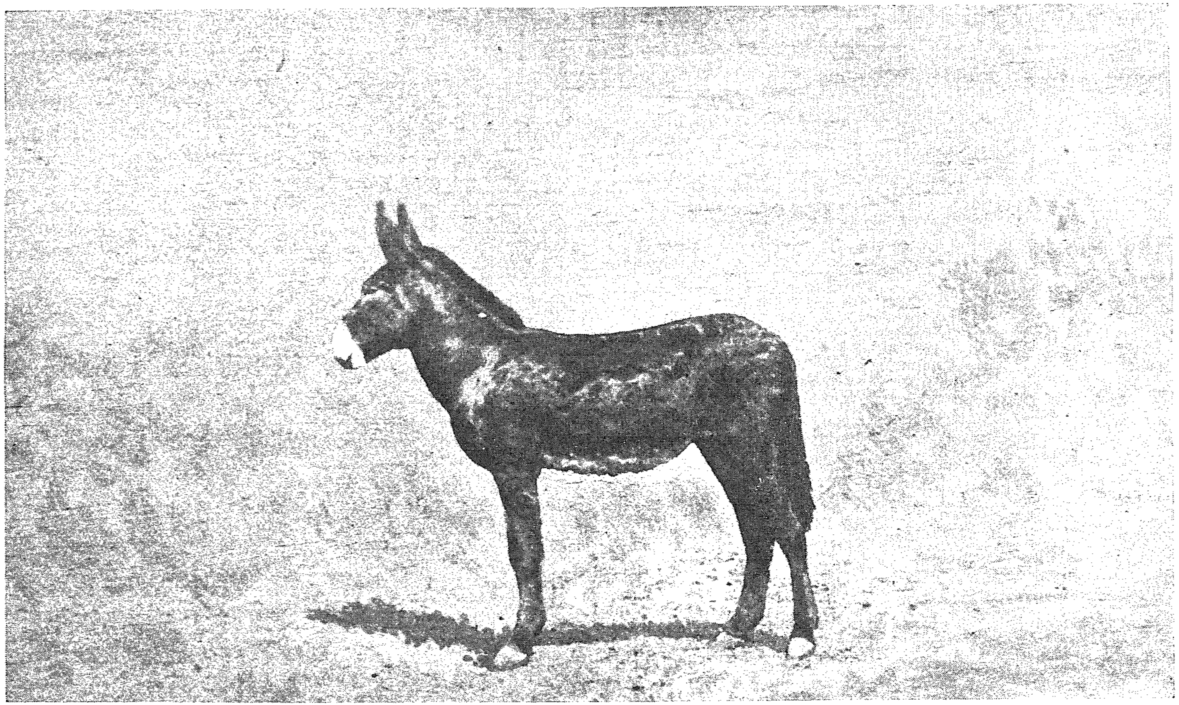
EXPORTING.—We have an inquiry from Holland for fresh grapes (says the *Fruit World*); the prices are quoted at rather low rates, but such have no guidance to Australia, as her grapes would arrive when there is no competition from Italy; and for good stuff the market would be firm and profitable. The grapes will carry to any part of the world; a N.S.W. grower had success in Canada, and South Australian growers had success in London. We would like to see an effort made to supply a trial lot to Messrs. Altona Bros., Rotterdam, Holland. This firm also requires samples and quotations for dried fruits, raisins, dried apples, etc. Australia can have a very large grape export trade if her growers will lay themselves out for it.

POISON PLANTS.—In this issue is published the first progress report on the examination of the poison plants of this State by Mr. A. C. Mann, the Government Analyst and Chemist to the Department of Agriculture. The work undertaken in connection with this inquiry will be readily acknowledged as most useful and important to all stock owners. The department has from time to time tried to carry the matter through, but without success. The advent of Mr. Mann, however, promises to bring the matter to a state of completeness that will be welcomed by all interested. The report will be illustrated by diagrams and photographs that in themselves will be a source of great interest, some of them being from highly magnificent specimens of the different portions of the plants examined.

FARMING IN ARGENTINA.—The following paragraph appeared in a recent issue of the *Western Mail*, and speaks volumes for this State:—"In the month of November a very considerable number of farmers left the Eastern States for the Argentine Republic to go in for farming there. The land regulations are very liberal, and the climate is admirably suited for stock-raising and wheat growing. Many of the large cattle-ranche owners are now cutting up their runs and letting them on long and easy terms for wheat-growing purposes. During the past two years the increased land put under wheat is nearly three million acres. Discussing the question with a farmer who had been there for some years, and is now in Western Australia, he states that the man who goes to Argentina when he can get land under the present regulations in Western Australia is a fool, as he can do much better here. He also stated that had he known as much about Western Australia before he went to Argentina he would be thousands of pounds to the good at present."

Milking by Machinery.—One of the most successful machines introduced into the dairying industry is the Laurence-Kennedy milking machine. The milking is done by fixing cups to the teats of the cow, a tube leading into an air-tight milk can, in which a small vacuum is continually created. The cups, which are attached to the teats, look simple enough, but are wonderfully ingenious, for the interior of each is an imitation of the mouth of a calf, the projecting lip and the roughness of the roof of the mouth. The lining of the cup is double, and the admission of air between the two gives the natural pressure of the calf in the act of sucking. The gentle suction is alternating, or pulsating, very much like nature's own means of milking by the mouth of the calf, much more so, indeed, than the hand of the human milker, for that is an unnatural pressure, whereas the calf draws the milk far more by suction than by pressure, so that by the machine we are introducing no unnatural method, but rather going back to nature's own plan. The regular rythmical action of the pulsator has a soothing effect on the animal, and, as all dairymen know, that is the one condition needful to insure the greatest milk flow both in quantity and quality. One machine then milks two cows at a time, and seven or eight changes can be made in an hour, making the capacity of one machine 14 to 16 cows milked per hour.

Burning out Stumps.—A Canadian exchange, in describing the method of burning out stumps by means of saltpetre and kerosene, says:—"In treating with saltpetre, we bore from one to three holes with a sharp two-inch auger, according to size of stump. If a moderate-sized stump one hole in the centre of the stump is sufficient, or if the stump is very large bore two or three holes in different sections. If at an angle to the grain they will bore much easier than straight down from the top. In each hole place one ounce of saltpetre, and fill each hole with rain-water and plug closely with wood. The water will dissolve the saltpetre and carry it to all portions of the stump, opening up the grain pores. As soon as the water is absorbed, which will be in from four to six weeks in dead stumps, and somewhat longer in green ones, uncork and fill the hole with kerosene oil and again cork tightly. As soon as the oil has been absorbed, which will be in a few days, possibly one week, the stump is ready to fire. We always manage to have a few small stumps or old litter to start a fire. After the fire is started it is not much trouble to get rid of the stump. We have had a large oak stump, five or six feet in diameter, burn entirely away, root and crown. The dry weather of autumn is the best time to burn them out, as the roots hold but little moisture then to retard burning. During the summer and autumn of 1892 we burned out a number of large oak stumps in this manner. A number of them were green, but we treated them to two applications of coal oil before firing them; however, they took a great deal of chunking to get them out of the way of the binder and plough.



American Mule-breeding Donkey (Imported by Mr. A. W. Edgar). Height, 15·2.

ANNUAL REPORT

For the Financial Year, June 30th, 1905.

DEPARTMENT OF AGRICULTURE.

Report of the Acting Under Secretary.

The Hon. Minister for Agriculture.

SIR,—I have the honour to submit my second annual report for the ten months ending 30th April, 1905, during which time I was Acting Director of Agriculture.

I attach a comparative statement of expenditure for the 12 months ending 30th June, 1905:—

Section.	Amount on Estimates.	Average provision for 12 months.	Actual expenditure, 12 months.	Average expenditure, 12 months.	Discrepancy per month.	Total discrepancy.
	£	£	£	£	£	£
Agriculture	28,969	2,414	25,805	2,150	264	3,168
Rabbits	17,964	1,497	7,701	641	856	10,272
Stock	7,446	620	6,091	507	113	1,356
	54,379	4,531	39,597	3,298	1,233	14,796

The total revenue received was, approximately, £10,110 17s. 4d.

The crop returns for the past year have not been so satisfactory as those of the year preceding, which is to be accounted for principally by the very wet season experienced in the Great Southern and South-West districts, where many of the crops were totally destroyed and others did not pay to harvest. The average yield of wheat for the season 1904-5 was 11 bushels, as compared with 13·6 the previous year; oats, 16·4 bushels as against 17·7; barley, 11·6 bushels as against 14·7; and maize, 10·7 bushels as to 15·3 bushels. Potatoes showed a slight increase, being 2·9 tons per acre, as against 2·5 the previous year. We produced 128,894 bushels of wheat in the season 1904-5 more than we did in 1903-4, and potatoes showed an increase of 1,065 tons. On the other hand, the oats produced were 31,947 bushels less and barley 15,426 bushels less than the preceding twelve months. Although the general averages are so low, on the other hand, in districts where only the normal quantity of rain was obtained, the crops yielded heavily, in some cases up to 40 bushels per acre.

It is gratifying to note that the use of artificial fertilisers is steadily increasing, and the farmers are finding that it pays to use them. The value of fertilisers imported last year was £43,748.

The Fertilisers Act that was passed during the year was found to be unworkable in its present form, and as soon as Parliament meets one or two necessary alterations are to be made, after which it will be enforced.

Experiments with fertilisers have been carried out during the year at the different experimental farms, and also at three experimental plots—one situated at Moonyoonooka in the Northern part, one at Mt. Barker, and the third at Dardanup.

The results at Moonyoonooka were:—

PLOT 1:	
Superphosphate, 1 cwt. per acre ...	... Yield, 14 bushels per acre.
PLOT 2:	
Superphosphate, 1 cwt. ,, Sulphate Ammonia, ½ cwt. ,,	... ,, 19 ,,
PLOT 3:	
Superphosphate, 1 cwt. ,, Muriate of Potash, ½ cwt. ,,	... ,, 18 ,,

In this case the addition of half a hundredweight of sulphate of ammonia, valued at 8s. 6d., increased the crop by five bushels, or a value of 15s. Half a hundredweight of muriate of potash, valued at 6s., increased the crop by four bushels, valued at 12s. per acre.

At Mount Barker the results were:—

PLOT 1:	
Superphosphate, 1 cwt. ...	... Yield, 10 bushels 43lbs. per acre.
PLOT 2:	
Superphosphate, 1 cwt. ... Sulphate of Ammonia, ½ cwt.	... ,, 12 bushels 57lbs. ,,
PLOT 3:	
Superphosphate, 1 cwt. ... Muriate of Potash, ½cwt. ...	... ,, 9 bushels 20lbs. ,,

The very wet season experienced in this district had probably a good deal to do with the poorness of these returns. The land was also new and probably somewhat sour, and after having been burnt off only recently there was possibly an excess of potash.

Further experiments have been arranged and test plots put in at Moonyoonooka (near Geraldton), Mt. Barker, Meckering, and Kellerberrin.

In the Geraldton district various varieties of wheat have been sent to five farmers in order to see what variety is best suited for the district.

A series of experiments with artificial grasses were carried out at Mullalyup in the South-Western district, and of them the field officer reports: Cocksfoot did the best of all; stood the dry weather, and yielded a supply of green fodder all the summer. Hungarian forage grass did well; grew early in the season, and kept green all the time. Kentucky blue grass spread out well, proved very hardy, and increased in area. Rye grass did best in the wet parts; grows early, but dies down in summer. *Paspalum dilatatum* grew splendidly, and proved itself an excellent fodder for summer. *Trifolium incarnatum* grew well and seeded freely, which came up early in the autumn. Red clover perennial grew well in spring and autumn. A few plants of salt bush (the *nummularium* and *semibaccatum*) were planted, and both did well.

Arrangements have been made for testing grasses this season at Newcastle, Meckering, West Beverley, East Beverley, and Westbrook.

In the early part of the year I saw that Dr. Moore, of the United States, had separated the various bacteria of some of the commoner leguminous plants, and had succeeded in putting the cultivations up in such a form that

they would carry freely and form the nucleus for other colonies. I wrote at once to the Department of Agriculture, Washington, and asked if some of the bacteria could be supplied. Owing to the great demand from all parts of the world we did not get any until March last, and then we got some suitable for red clover and peas. Shortly after I also received some more from the Agent General, who had also applied for some. With this supply a quantity of seed and soil was inoculated, and distributed throughout various parts of the State, and the results of the experiments are being looked forward to with much interest.

Stock still continues steadily to increase, and it is particularly gratifying to see that in the farming districts there has been a very considerable increase in sheep, showing that at last the farmers are beginning to recognise their value. Pigs have also shown good increase for the year that's past, there being an increase of almost 20,000 over the returns of the previous year; but we still want a great many more if we are going to do anything in the way of producing our own ham and bacon.

Potato-growing, although making steady progress, has been very much handicapped by the great difficulty experienced by the farmers in getting clean, healthy seed. A very small quantity of potatoes is grown in this State for seed purposes, most of the growers depending almost entirely on the Eastern States, and the seed procurable there last season was nearly all diseased and not fit for planting. To try and overcome the difficulty some seed potatoes were imported from Scotland and grown at the Hamel Experimental Station, and the crop from these was made available for the public. The trial was so successful that I intend importing a much greater quantity next season and going in for potato-growing at Hamel on a much larger scale, so as to be able to send out a considerable quantity of new varieties of potatoes of good quality, sound constitution, and heavy yielders. Most of the varieties now grown in the State are potatoes past their prime, whose constitutions are run down and very susceptible to disease.

Sheep are attracting a considerable amount of attention amongst the smaller farmers, especially in the Great Southern district, and only the difficulty of obtaining them has kept them from being almost universally kept in that district. To meet this, the Government are considering the advisability of purchasing some thousands in the North and then supplying them in lots to suit the farmers, at actual cost price. This will probably be given effect to in the coming year. Once sheep are properly gone in for in the Great Southern and Eastern districts they should be able to produce sufficient to almost meet our requirements without having to draw supplies from the North.

Dairying still advances slowly, but it is steadily advancing, and there are now two butter factories at work in the State—one at Busselton and one in Perth; besides which there are several receiving stations in the South-West where milk is received and pasteurised and forwarded on to Perth.

We have had a number of new settlers from the Eastern States who, after having had a run round the country, have decided that the dairying industry offers good inducements and are now settling down here and getting together fair-sized dairy herds; the establishment of the butter factory in Perth has also acted as a stimulus, and many of the dairy farmers are now increasing their herds, as, by sending the milk or cream to the factory they get rid of the trouble of making the butter at home. It may be stated that

the butter business is now about fairly started on the factory system, and there have been a number of inquiries about starting new factories in other districts. A decrease in the wages of farm labourers or dairy hands would mean a big increase in the dairying industry. The quality of the butter locally made is quite up to that of the Eastern States, and the type of cattle to be found on the farms is quite up to, if not above, the general average of Australia.

Practically no attention whatever has been given to cheese-making in this State, although it is one of the best-paying industries that many farmers could go in for, especially those who are situated at a considerable distance from a railway station, as a load of cheese could be sent to market, say, once a month, and thus but little time wasted in cartage. There is a good demand for cheese, and if new cheese were put on the market the demand would be much greater, and the price at which it could be sold would give much better profits than by using the milk for butter-making. The total value of cheese imported in 1904 was £27,504, and of this amount £22,000 came from the Eastern States, and is of the kind of cheese that can easily be manufactured here. Less than £5,000 worth of what may be termed the fancy cheeses were imported, the rest being what is known as colonial.

We have made but little progress in the production of ham and bacon, but the signs are not wanting that a move in that direction is contemplated. Pork has been plentiful this past year, and prices have dropped very considerably; and we seem to have reached that stage when our production of pork is equal, if not rather greater than the demand, and this state of affairs must of necessity find a remedy in the establishment of bacon factories. So long as high prices were ruling for pigs it would not pay to turn them into bacon; but now with reduced prices, and the probability of still lower rates ruling through increased production, the curing industry may be looked upon as within measurable distance. We imported ham and bacon to the value of £130,361, as against £138,386 the previous year. Probably, considering the amout of capital required, with the exception of poultry, pigs pay better than any other kind of stock that can be kept on the farm, and, even at considerably reduced prices, will continue to pay well for many years to come.

Our egg bill for the past year amounted to £80,055, as against £73,538 the previous year, and that notwithstanding that poultry keeping is becoming more popular than ever, and that higher prices have been paid for imported stock during the year than at any previous period. With the number of poultry we have in this State we ought to do better in the way of egg-production, and I can only account for this on the grounds that by far too much stress is laid on the fitness of fowls for show purposes and but little attention given to their egg-producing qualities. Much more importance is given to a bird with a few extra markings on it, or a particular colour of the eye, the beak, or legs, than to its laying capacity, the latter quality as a matter of fact not being taken into consideration at all. In the year 1903 we imported poultry to the value of £1,091, and in 1904 to the value of £1,743, and as a considerable number of these were for breeding purposes it will be seen that, for table purposes, our supply is almost equal to the demand. Last year I recommended that a poultry farm should be established in connection with one of the experimental farms, and the experience of the past year has emphasised the nesessity for such. I have had many

applications from local people, and also from new arrivals, especially from England, asking if they could go to one of the farms and have a course on poultry farming, as they wished to go in for that industry. If we had a regular course of poultry at one of the farms and special attention given to the breeding, rearing, and dealing with utility fowls as compared with purely show birds, it would be a forward step in producing sufficient eggs to meet our own consumption instead of sending so much money out of the country annually. I would strongly recommend that steps be taken to try and establish this industry on a practical footing.

The agricultural lectures initiated in the previous year that proved so successful were continued during the months of July, August, and September, in the lecture hall at the departmental offices in Perth. They were well attended, the average over the course being about 80, and the interest was so keen that people from the country came specially down to them. It was intended to continue them the next year and also to extend them to the country districts. Other lectures on special subjects were given in the country districts, and on poultry and beekeeping in the mining districts. With the water scheme in working order now on the Eastern Goldfields, a series of lectures and demonstrations on fruit and vegetable growing should be very acceptable and productive of good results, as already good returns have been obtained by those who have started vegetable and fruit-growing there.

In connection with the administration of the Insect Pests Act, it is gratifying to be able to state, on the authority of the Chief Inspector, that, with the exception of the fruit fly, the other pests are decreasing, in some instances through the introduction of parasites, and in others through spraying, etc., and a better knowledge of how to deal with them. The potato moth, the scale, and woolly aphis still continue to give a considerable amount of trouble. Fungoid diseases have been kept fairly well in check, but there are continually new varieties occurring that require identification, and as we have not a vegetable pathologist in connection with the department we are often not able to recognise them. For the proper carrying out of the work a vegetable pathologist should be attached to the department, and such appointment would probably lead to the saving of thousands of pounds worth of fruit and vegetables each year.

There are eight inspectors, including the Chief Inspector, who controls and checks the work of the others. Five of these are stationed in the country, one is employed in relieving and helping in places where there is a press of work, and one for Perth and suburban gardens, auction rooms, shops, etc.

In 1903 there were seven gardens in Perth in which codlin moth were found. The gardens were kept under continual observation and dealt with, with the result that no trace of either the moth or grub was found this past season.

At Albany, in 1903, 16 gardens were found to be affected. These were also kept under observation and dealt with, and only in one garden were the grubs or moths found, but one fresh case was discovered in another garden. It is expected that no cases will occur next season.

San José scale has been found up to the present in 297 orchards; of that number 166 are now clear and 131 still infected, and the most of the trees in these orchards but mildly infected.

The introduction of parasite for the black and brown scales have been so effective that these scales cannot any longer be considered as a serious pest.

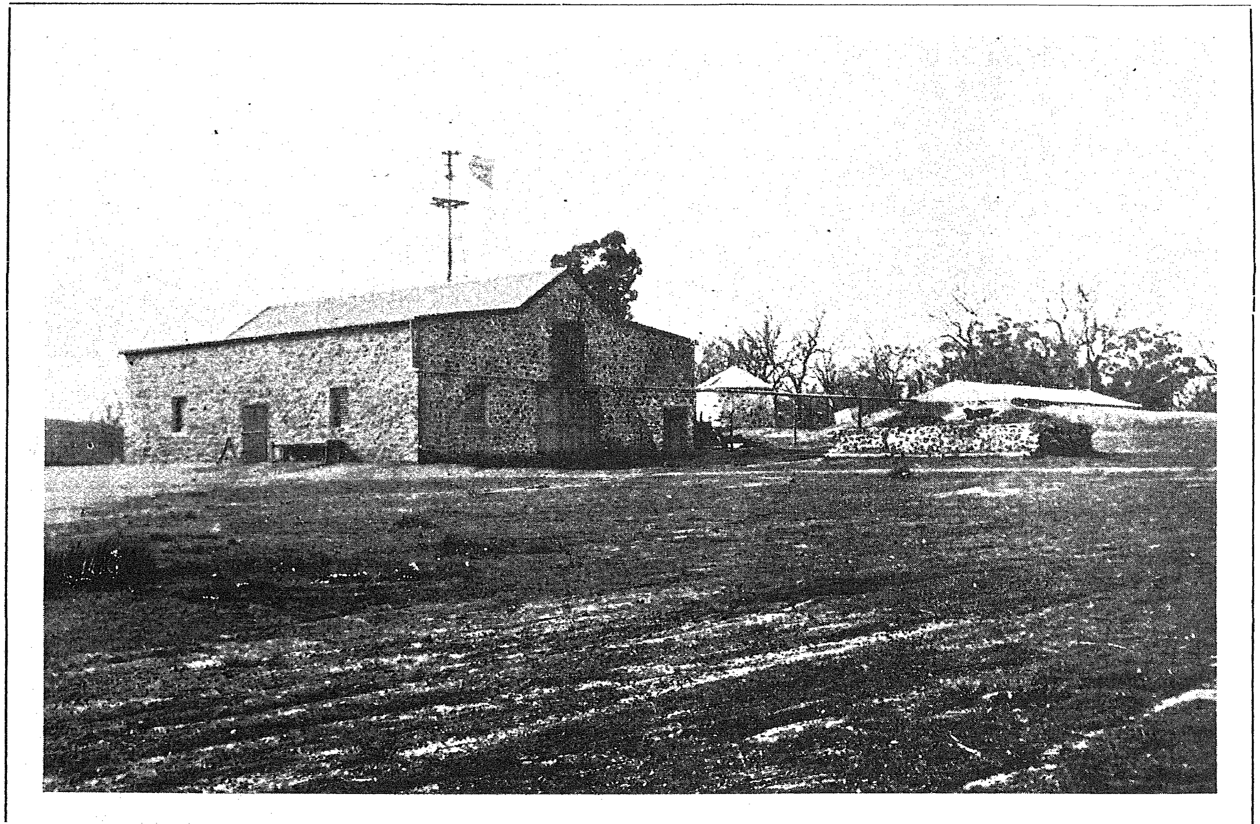
The ravages of the fruit fly still continue, and up to the end of this year 450 cases of fruit were seized and destroyed at sale rooms and shops on account of being infected, as against 421½ cases the previous year. This does not at all represent anything like the loss in fruit, for but few people ever think of sending infected fruit to market if they are aware of it, and this only represents the fruit that escaped notice. Unfortunately, the pest is still spreading, and during the past year has been found in districts in which it had never been found before.

The parasites introduced by Mr. Compére last year for the fruit fly, and which were kept in a cool place to retard their hatching out until the fruit fly made its appearance, I regret to say were so weakly when hatched that they did not live to reproduce themselves. The predatory beetle, a *staphylinid*, however, were active, and were put out in a garden in Perth, but whether they reproduced or not we have not yet been able to ascertain. Mr. Compére later on obtained a large number of these beetles, and in order to have the natural food ready for them on their arrival I had a small house erected, and here we kept a large quantity of infected fruit with many thousands of the fruit fly maggots ready for them. When Mr. Compére arrived with the beetles they were turned into the diseased fruit and immediately set to work destroying them. Here the beetles are breeding, and when the fruit fly season comes round again we hope to have many thousands ready to turn out, and it is believed that they will prove an effective check to the fruit fly, although it is not the actual parasite.

Beekeeping still continues to make steady progress, although the import of honey during the past year was greater by some £1,800 than the previous year. This is accounted for by the fact that the former year was one of the worst that the beekeepers here had yet experienced, and few of the beekeepers obtained a surplus of honey for the market. That in normal years the approximate supply and demand is very close is shown by the fact that the previous year the value of the honey imported was only about £1,000. As I pointed out last year, I do not think there is any advantage in pushing this industry, as, if we have a surplus, there is no profitable means of getting rid of it, there being no market in Europe for Australian honey at a price that would pay to export, and the result would be that we would have a glut here and not know what to do with it.

The Bee Expert, in his annual report, states:—"It has exercised the minds of many friends to the industry, some of whom have doubted the wisdom of developing it, seeing that the market is somewhat limited and almost overtaken by those already engaged in the pursuit, and this in the face of large quantities being constantly imported from the neighbouring States."

In accordance with my suggestion, the *Journal* of the department has, during the past year, with the approval of the Hon. the Minister (Mr. J. M. Drew), been issued free to all *bonâ fide* settlers who apply for it, and who make their living from the land; and to make up the extra expense thus entailed advertisements have been inserted so that the State will not suffer any loss thereby. If is gratifying to find how much the *Journal* is being appreciated, as is evidenced by the fact that back numbers are being continually applied for. It was also appreciated to such an extent that news-



Combined Barn, Stables and Cow-shed at Narrogin Experimental Farm.

papers, magazines, etc., were copying its articles wholesale in their columns without acknowledging the source from whence they obtained them; and so that the *Journal* might receive its full credit I had its articles copyrighted. The library and newspaper department continue to receive considerable attention, and I would again draw attention to the good effect that a lending library would have. Many people come in to read up works on certain subjects, but their time is limited, and they are not able to spare the time required to master the desired information. Many of the standard works on agricultural subjects are very expensive, and many farmers cannot afford to purchase them, and a lending branch would, I think, be greatly appreciated by the thinking community. The more we can educate the tillers of the soil on the principles and reasons for doing work, and the effects and reasons for using the various kinds of manures, the better will be the system of cultivation and the result will be more regular and heavier crops. In going about the country I took the opportunity of examining many of the books in the libraries in mechanics' institutes in the country districts, and, with one or two exceptions, I failed to find any standard works relating to agriculture or stock; and, as I have suggested before, I would again strongly urge that where the Government grant financial assistance to such institutions a condition should be that certain standard works on agriculture and stock should be purchased. A list of such works could be obtained from this department, and in all cases it would be advisable to do so, as there are a great number of books published on these subjects—to sell—that are of but little practical value to the farmers in this State, or anywhere else for that matter.

The Government Botanist reports that the duties of his office have been carried out on much the same lines as in previous years.

The number of plants received at the department for identification and information has been greater than in any previous year. Among those forwarded as suspected poison plants there have been *Brachysema præmorsum, Oxylobium capitatum, Tephrosia porrecta, and T. purpurea.* As specially noxious weeds, were sent *Sida retusa,* from Wyndham, and a species of *Bidens* with barbed pappus-bristles, that cause damage to wool. The poisonous grass *Lolium temulentum,* Darnel or Drake, came into notice in the Supreme Court, wherein an action for damages on account of impure seed-wheat supplied, the facts of its wide distribution in the State, and its frequent use as food for fowls and pigs without harm resulting, were brought out; while recent views regarding its poisonous action, when observed, being due to a fungus infesting the grain, were brought into prominence.

The results of the analysis, by Mr. H. G. Smith, of various eucalyptus barks, for which material was supplied by the department to the Technological Museum at Sydney, were received and published in the *Journal* of the department.

An additional herbarium press has been procured, and progress has been made in the arrangement of the specimens in the herbarium. A number of specimens were mounted for the Adelaide Exhibition, and specimens of the grasses found in the State were similarly prepared for convenient consultation. Excursions were made to different districts for the collection of botanical specimens, and a considerable number thus added to the herbarium. The article on the Flora of the State, as re-written, has been

published in the *Year Book;* and also one on the possibilities of cotton-cultivation in Western Australia.

The work done at the Government Refrigerating Works still keeps increasing, and the revenue for the past season was £3,829 1s. 3d., as against £3,667 the previous year, while the expenditure was £7 less. It was possible to have increased the returns somewhat by the utilisation of the general stores, but it was deemed advisable to have some space in reserve for shipments of meat. The ice business has greatly increased, and the supply was, during a part of the year, not equal to the demand; but it is expected that after the annual overhaul and an alteration in working during the coming year, that the supply may be so increased as to meet the demand. The machinery ran well and without mishap during the year, but it will need a considerable overhaul this coming year, and the whole premises are badly in need of being painted to preserve them from the weather.

The work done at the Hamel Experimental Station has been very satisfactory, and amongst other things it has been demonstrated that hop culture in that district is likely to be attended with good financial results. Experiments have also been carried out with a large number of various kinds of potatoes, a number of the latest varieties having been imported from the United Kingdom for that purpose. Some of these were a decided improvement on the local varieties, and a considerable quantity of the seed has been distributed in various parts of the State. While we have mostly been depending upon the production of new varieties by other people, Mr. Berthoud has been experimenting with the raising of new varieties that may possibly suit local conditions better than any imported varieties would. He has grown some thousands of seedlings, and from these selected the ones that appear to be most suitable; these will be grown again and further selected, and it is to be hoped that success may crown his efforts. During the year I had an experimental test orchard established at Hamel, and over 400 fruit trees were planted, and out of this number only four died; there are 54 varieties of apples, 10 of apricots, six of almonds, four of cherries, five of chestnuts, nine of figs, one of guavas, three of lemons, four of loquats, three of mulberries, one of medlars, six of nectarines, seven of oranges, one peanut, 13 of peaches, eight of persimmons, 26 of pears, five of plums, nine of Japanese plums, two of prunes, seven of quinces, two of walnuts. This orchard ought to be a good object lesson and of great value to the whole district, as it will be demonstrated what particular varieties of fruit trees are best adapted to it. Experiments made with grasses go to show that some of the most important and best doing are:—Rhodes grass, *Paspalum Dilatatum,* sheep's Burnet, Bokhara clover, Falling Awn grass, and African Wonder grass.

Very extensite experiments were made in the growing of wheat, oats, and barley, and the results, many of which have been particularly interesting, have been published in full in the *Journal* of the department.

The cotton crop turned out a failure this year on account of the plague of grubs that ate the plants down, and in many cases right out when young.

RICE.—Five kinds were grown during the past summer—Two Egyptian, one Japanese, one Carolina, and one Italian.

The two sorts mentioned below matured early and gave good returns of nice plump grain. These two are most suitable for cultivation in the swamps of this and similar cool districts. The Carolina and others, although

they made strong, healthy growth, failed to mature grain before the winter rains set in. All the varieties would be successful if grown in the warm coastal districts of the northern portion of this State.

"*Bertone.*"—Variety from Piemont, Italy; imported seed sown 22nd October; germination quick and even; growth vigorous and healthy; foliage wide, stiff, upright, of a pale green; straw strong, stands up well; height two feet, level and neat; headed middle of February; ears long, well filled, and beardless; ripe from end of March to early in April; does not come in as evenly as wheat; yield good, at the rate of 900lbs. per acre; grain plump; colour when husked, pure white, and of superior quality; early and prolific.

"*Yamani.*"—Egyptian variety; imported seed sown 23rd October; germination strong and even; growth upright and strong; straw stands up well; foliage wide, of a pale green; height 2ft. 6in.; very even; heads long, closely filled, bearded; ripe first week in April; grain long and fairly plump; yield at the rate of 900lbs. per acre; colour when husked clear white; appears to be of a very fine quality; early and good.

Two high-class Berkshire sows and a good boar were supplied to this farm during the year, particularly at the request of some of the Hamel settlers, who wished to have the services of a good boar in the neighbourhood, and to be able to obtain well-bred young pigs.

At the Narrogin Experimental Farm a very wet and severe winter was experienced. The hay crop was not as good as it ought to have been, and yielded as follows:—

Variety.	Date sown.	Manure at rate of 90lbs. per acre.	Description of soil and preparation given.	Yield per acre in tons.	Remarks.
WHEATS.					
Baroota Wonder	May 4	Part Superphosphate, part Bone-dust	Good red loam; new land. Summer-ploughed and scarified	1¼ to 1½	A good clean-strawed, bulky hay wheat
Medick ...	May 3	Part Guano, part Super. Bone	Good red loam; new land. Summer-ploughed and scarified	1¼	On low land. Suffered from excessive wet. A good hay wheat
White Lammas	May 6	Part Super Bone, part Bone-dust	Hard, red land. Ploughed and cropped with very rough tilth	1	A good hay wheat; tall grown
White Lammas	May 21	Part Guano, part Superphosphate	Poor gravelly land—stubble. Ploughed and sown again	½ to ¾	
Jade ...	May 23	Part Superphosphate, part Super. Bone, part Bone-dust	Poor gravelly land—stubble. Ploughed and sown again	½ to ¾	Light crop of good quality hay
Australian Talavera	May 20	Super. Bone	Poor gravelly land—stubble. Ploughed and sown again	¾	Light crop of nice quality hay. A good hay wheat
Sullivan's Early	May 17	Super. Bone	Rather poor, new land, but summer-ploughed	1¼	A fairly heavy crop, but not a good hay wheat, being coarse and hard in the straw and chaff
Sullivan's Early	May 18	Guano	Low-lying stubble land	¼ to ½	Suffered more than other wheats from excessive wet
OATS.					
Chinese Hulless	May 13	Guano	Good red stubble land; rather roughly prepared	¼ to ½	Not much good for any practical purpose
Algerian ...	June 9	Super. Bone	New land. Fairly nice loam. Ploughed and sown direct.	1 ton	A fair crop of nice quality hay. A good mid-season oat
American Early Ripe	June 7	Super. Bone	Part new land and part stubble. Ploughed and sown direct. Part low-lying near creek	¾ ton	Crop suffered from wet. A good early oat; good quality hay

The Grain Crop was all cut with the binder, and threshed with one of Messrs. A. W. Grays Sons' horse treadmill theshers. Threshing was commenced on 19th December, 1904, and completed on the 16th January, 1905. About 1,200 bushels were taken off of 93 acres, the results being as follow:—

Variety.	Date sown.	Manure at rate of 90lbs. per acre.	Description of soil and preparation given.	Yield in bushels per acre.
WHEAT.				
Alpha	April 25	Bone-dust ...	Good red jam country. Summer ploughed. Suffered from excessive wet	7·5
,, ...	,, 25	Superphosphate		
Jade	,, 28	,, ,, ...	Part same as Alpha, part coarse rubble land. New.	10·5
Australian Talavera...	,, 29	Part Bone-dust, part Guano	March ploughed, brashy rubble. Poor country	11·0
Medick	May 3	Part Guano, part Super. Bone	Summer ploughed. Good loam. Rather wet	13·8
Baroota Wonder ...	,, 4	Superphosphate ...	,, ,, ,,	11·4
Sullivan's Early ...	,, 11	Part Bone-dust, part Superphosphate ...	Part good loam (wet), part brashy rubble. Ploughed new land	13·8
Fillbag	,, 16	Superphosphate ...	Part good loam (wet), part rubble. Poor land	16·6
Federation	,, 16	,, ,, ...	,, ,, ,,	16·3
Marshall's No. 3 ...	,, 19	,, ,, ...	,, ,, ,,	19·5
Sullivan's Early ...	,, 19	,, ,, ...	,, ,, ,,	15·0
BARLEY.				
Malting, Chevalier ...	,, 31	,, ,, ...	Part loam, low-lying; part deeply ploughed, white sand. New land. Ploughed and sown	15·0
Cape	June 21	Super. Bone	White sand. New land. Ploughed deep	14·0
OATS.				
Chinese Hulless ...	May 13	Guano	Stubble land. Ploughed and sown	Very poor; cut for hay
Algerian	June 9	Super. Bone	Loamy to white sand. New. Ploughed and sown	14·2
American Early Ripe	,, 7	,, ,, ...	Loamy to wet, hard land near creek	14·6

Rye.—Sown 12th May on stubble land; ploughed up and manured with 90lbs. bone-dust; gave about 1 ton to the acre of greenstuff for the silo in October. The second crop was promising, but only gave $2\frac{1}{2}$ bushels of grain to the acre, many of the heads being dummied.

Note.—It must be observed that these experiments have been conducted not only as experiments but as the main crop. The date of sowing, kind of soil, and the kind of manure and cultivation applied varying greatly; consequently the tests are not conclusive, and it is difficult to draw even approximate comparisons.

A number of small plots of imported potatoes were set with about 4cwt. of bone-dust per acre. The potatoes were all very poor seed sown, and although many of them failed a few very promising varieties have been selected.

Crofter.—A very prolific, shapely potatoe, similar to the Beauty of Hebron, but more uniform in shape. A useful variety.

Idaho.—Fairly prolific, round, white potato.

Circassienne.—Kidney-shaped, long and wasty; fairly prolific, but small.

British Queen.—Similar potato to Crofter in shape, but poor.

Crapandine.—No good.

Waverley.—Brown, flattish, similar to Crofter in shape; prolific, good, very deep rooted.

American Chili.—Small, round, purple; poor.

Dobbie's Favourite.—Fair, white oblong potato, not very prolific.

Other varieties that failed were—"Arancana Blanca Chili," "Mangu Blanca Chili," "The Norwich," "Sirdar," "Purple Russet," "Abundance," "Cangui," "Doye's Chili," and "Princess May."

Of all the above-named varieties "Sutton's Flourball" appeared to suit the conditions best, giving a very fair crop of fine sampled potatoes.

In the manuring, stable manure showed very marked results, giving a little body to the loose white sand.

No potassic or nitrogenous manures were tried, but I am inclined to think that their addition would have materially increased the crop, particularly in the absence of the stable manure.

The flock of Angora goats sent to the farm some time back were shorn last October and dipped, since when they have thrived wonderfully well. Four kids dropped about three months back have done splendidly, although one of them succumbed to poison a few weeks ago. The Angora is, I think, fully as liable to the effects of poison as the sheep, and, being naturally a browser, they attack the poison shrubs almost more readily than sheep. At present, however, they are all kept busily occupied in the stinkbush thickets, touching little else, and requiring practically no water at all.

Last winter these goats did not thrive here very well owing to the excessively wet weather, and also partly on account of their not being acclimatised. It will be interesting to watch their progress during the coming winter, when they will have become more used to the conditions and climate.

Cattle have not done as well as was expected. Some pedigreed Ayrshire cows and a bull have been kept for the past three years, but on the recommendation of the Advisory Board it has been determined to try Dexter and grade Dexters, as they may suit the poor country better.

A small stud flock of pure Shropshire sheep is kept, and the general flock consists of Merinos and grade Shrops.

Some high-class Berkshire pigs are bred, and lately the Large Blacks have been introduced.

There has been a good demand for the position of students, and, owing to the unsafe condition of the building used as students' quarters, many applicants have had to be refused until they have been practically rebuilt, arrangements for which are being made.

The season experienced at Chapman was, on the whole, a very fair one, and the result of the grain crop was as follows:—

The grain crop was harvested during the month of November and the first week in December. It was all cut with the binder and threshed with the new treadmill threshing plant. The area threshed for grain was one

hundred and fifty (150) acres, which yielded about 2,500 bushels, the results being as follows:—

Variety.	Date sown.	Manure, rate per acre.	Character of Soil.	Yields per acre in bushels.
Sullivan's Early Prolific	May 21	Abrolhos guano, 70lbs. ...	Good light loam; second crop	14·0
Silver King	June 2	Cumming Smith's Super., 112lbs.	Good red loam; first crop ...	12·4
Field Marshal	,, 2	,, ,, ,, ,,	,, ,, ,, ...	12·0
Cerraf	,, 2	,, ,, ,, ,,	,, ,, ,, ...	10·5
Australian Crossbred 13	,, 2	,, ,, ,, ,,	,, ,, ,, ...	18·0
Steinlee	,, 2	,, ,, ,, ,,	Rich ,, ,, ...	18·0
Australian Crossbred 1/J	,, 2	,, ,, ,, ,,	Light loam ,, ...	12·0
Alpha	,, 12	,, ,, ,, ,,	Rich red loam ,, ...	16·0
Australian Crossbred 77	,, 22	,, ,, ,, ,,	,, ,, ,, ...	13·6
Majestic	,, 25	Japanese Super., 112lbs. ...	,, ,, second crop	15·0
Jade	July 6	,, ,, ,, ...	Medium red loam; first crop	12·0
OATS.				
Algerian	June 30	,, ,, ,, ...	Good rich loam; second crop	30·0
American Early Ripe ...	,, 29	,, ,, ,, ...	Part rich loam; part poor gravel	20·0
Chinese Hulless... ...	,, 29	,, ,, ,, ...	Part rich and part poor gravel	8·0
Australian Crossbred 23	,, 29	,, ,, ,, ...	Medium red loam; second crop	32·0
Garton's B.	,, 29	,, ,, ,, ...	,, ,, ,,	12·0
Cape Barley	July 13	No manure	Good red loam; first crop ...	21·5

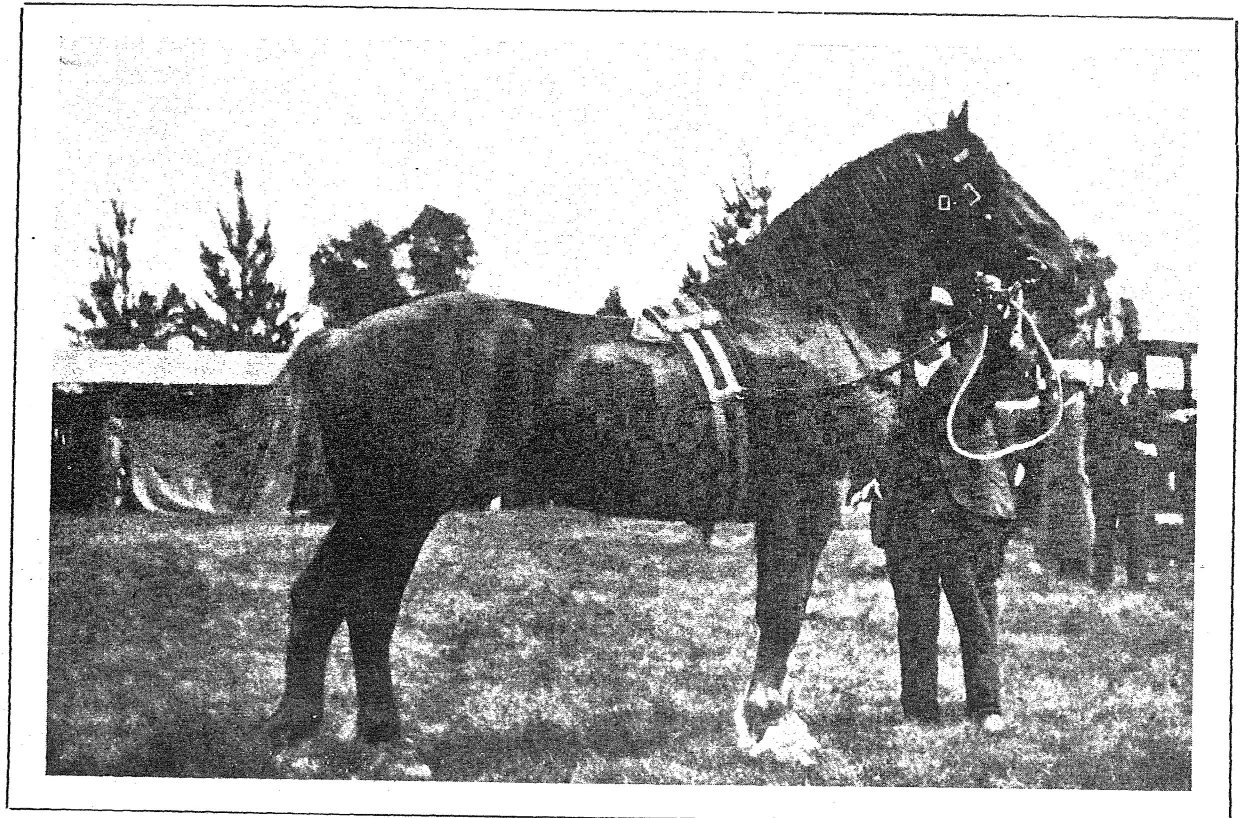
Harvesting operations were commenced on 17th October with hay-cutting. The weather was stormy, with heavy rain, which lasted for some days, greatly retarding the work. The hay, however, was well stooked, and very little damage was done. As we have no means of weighing the crop, I can only estimate approximately the result of the hay crop.

Estimated results of hay crop as follows:—

Variety.	Date Sown.	Manure, 70lbs. per acre.	Character of Soil.	Yield per acre in tons.	Remarks.
WHEATS.					
Sullivan's Early Prolific	May 12	Japanese super. ...	Medium sandy loam; second crop	1½	Fair quality
Clinch's IXL	,, 23	Cumming Smith's super.	Light sandy soil; second crop	1	Good quality
Queen's Jubilee	June 28	Japanese super. ...	Good red loam; second crop	1½	Straw strong; good hay wheat
Majestic ...	,, 25	Japanese super. ...	Good red loam; second crop	1¼	Stands well; good quality hay
OATS.					
Algerian ...	,, 30	Japanese super. ...	Medium red loam; second crop	1¼	Fine straw; good quality hay

Of the grasses planted last year, several of the varieties have done remarkably well, while others suffered very much from the heat of summer. *Eragrostis Silosa* grew vigorously, and kept green till the end of January. *Paspalum dilatatum* grew well, but dried off early.

Paspalum virgatum, a coarser variety than the *dilatatum*, made good growth, and remained green until well into the summer. Prairie Grass did well, but dried off early. Wallaby Grass (*Dauthonia pemallata*) grew vigorously, and is now starting to shoot out again. Sheep's Burnett, a very close creeping grass, has held its own through the summer; although sheep have been grazing on it right through the hottest weather, it is still green. Kentucky Blue Grass has not done well, but it, too, was closely cropped by



Suffolk Stallion "War Dance," winner of Champion Prize at Royal Show, England. Stationed at Chapman Experimental Farm.

the sheep. West African Wonder Grass would, I think, have shown good results, but as there were only a few plants the turkeys and poultry bestowed too much attention upon it for its good.

Summer crops have been found to do much better than was expected in this district. One paddock of 14 acres was sown with millet and early amber cane in September. Twenty-five sheep and three horses were put into it on the 15th of December, and they were still in it and doing well in May. Rape sown in September was eaten close down to the ground four times, and when the winter rains came, sprouted again and gave some more good feed.

Potatoes have done well, and also many kinds of vegetables; and this coming year it is intended to have a considerable area of potatoes put in.

The stock have all done well during the year.

Eight pure-bred Suffolk mares were purchased from the Messrs. Dangar, New South Wales, during the year, and of these four have been broken in to work on the farm, and have turned out excellent workers.

Thirteen farm and Suffolk mares were served by the Suffolk stallion, so there should be some fine young stock on the farm this coming year.

The cattle consist of a herd of pure-bred Dexters, and as they were getting inbred, and there was no possibility of getting any fresh blood in the States, we imported four pure-bred pedigree heifers in calf to different bulls and unrelated, also two young bulls, from England. Three heifers and one bull were sent to Chapman Farm and one heifer and one bull to Narrogin. The other cattle consist of half-bred and grade Dexters.

The sheep consist of a stud of pure pedigreed Shropshires started with ewes from Tasmania and South Australia, and some high class rams. It is rapidly increasing now, and stud rams are sold each year.

The ordinary flock was originally Merino and Lincoln, but it is now mostly grade Shropshire.

There is also a flock of pure Angora goats, and they are thriving well, and there is a good demand for young stock.

The pigs comprise several very high-class Berkshire sows and a boar, imported from England, and some good large Blacks.

The poultry consist of Dorkings, and gold and white Wyandottes; the flock of bronze turkeys is one of the best in Australia, and some of the gobblers have weighed as much as 39lbs.

Additional students' quarters were added during the year, and we have now some 12 students, most of them having come direct from England. Further accommodation is badly needed. During the year two students, who came out from England the previous year, have left the farm and taken up land in the district, and are making homes there for themselves.

Arrangements have been made for the establishment of a citrus orchard. This fruit does well in the district.

During the year horses, pigs, poultry, cattle, sheep, vegetables, grain, and hay were exhibited for competition at the National and Royal shows, and out of 21 entries 18 first prizes were obtained.

The following particulars of the Narrogin and Chapman Experimental Farms may be interesting :—

Narrogin Experimental Farm consists of 1,726 acres, and of this there are about 400 first-class land, and the balance mostly poor second-class and third, with a very large area infested with box and York Road poison. Two hundred and seventy acres have been cleared and cultivated, 1,000 ring-barked and poison-grubbed, 10 acres orchard and vineyard, 266 acres ring-barked poison country, 136 acres Jam country (rung), 34 acres creek and granite land, and 10 acres round homestead. There are about 12 miles of fencing. The buildings consist of manager's house, two cottages, students' quarters, barn and stables, buggy-shed, hay-shed, silo, and dairy. The stock :—12 horses, including foals; cattle, 15 head; pigs, 55; sheep—stud Shropshires 17, flock 263; Angora goats, 19; common goats, 4; poultry, 183.

Chapman Experimental Farm has 1,278 acres. Cleared and cultivated, 393; rung, 458; unimproved, 427. Of this there are about 500 acres first-class, 200 second-class, and 500 third-class and poor sand-plain. The buildings consist of manager's house, one cottage, students' quarters, dairy, stables, barn and chaff-house, implement shed, and kitchen. There are about 16 miles of fencing. The stock consists of one Suffolk stallion, imported from England; eight pure pedigree mares; eight draught mares and six foals, and eight horses; cattle, 30 head Dexters and grade Dexters; stud Shropshires, 25; flock sheep, 180; pigs—five stud Berkshires, 15 stud Large Blacks, and 32 cross-bred; pure-bred Angora goats, 34; turkeys, 76; other poultry, 60, and 30 guinea fowls.

The Perth City Markets, formerly under the control of this Department, have been during the year transferred to the Public Works Department.

Mr. Cairns, of Queensland, was appointed as manager of the abattoirs; and it is hoped that these very necessary buildings, if not fully completed, will at least be well on their way towards completion before the end of next year.

There have been several outbreaks of so-called swine fever at intervals during the past year, but it is very doubtful if ever we have had swine fever here at all; and I think that there need be but little anxiety on that score so long as we strictly prohibit swine from the Eastern States, where there seems to be no reasonable doubt as to its existence.

Poultry tick still exists, and causes a considerable mortality amongst fowls, but strict steps have been taken in dealing with it, and it is hoped that it may be kept within the bounds where it already exists, and not allowed to spread into the clean areas.

The reports of the Chief Inspector of Stock and the Horticultural and Viticultural Expert are attached.

During the year Mr. Baker, formerly editor of the *Journal of Agriculture*, resigned his position, and Mr. Spearman was appointed in his stead.

Mr. Lowe, on the recommendation of Mr. Compére, was appointed Assistant Entomologist, and came out from England to fill that position.

Mr. Gresham, who has been manager of the Government Refrigerating Works for the past nine years, resigned, and Mr. Cairns is acting in his place.

The construction of the rabbit-proof fence has been rapidly proceeded with, and the No. 2 fence is now completed—in all, a distance of 473 miles. The main or outer fence has been completed for a distance of over 600 miles from the coast, and both fences are now in a good state of repair, and regularly inspected by boundary riders. In many places along the outside fence rabbits are to be found in great numbers, and during a trip I made between Starvation Boat Harbour and Burracoppin I noticed many dead rabbits through the poison country; still it seemed to have very little effect in checking them, as live ones were very numerous, so that but little hope can be held out as to poison bushes acting as a check.

Between the two fences—the No. 1 or outer, and the No. 2 or inner—rabbits have been found in many places, and in one or two instances they have even reached the No. 2 or inner fence. Trappers are now constantly employed in eradicating and keeping these down, and with the extended use of rabbit-proof netting, which can be obtained from the Department on long terms for repayment, even if the rabbits are not ultimately eradicated they can be kept well in check, and, after the first expense in netting, give but little trouble. When going in for rabbit-proof netting it would minimise expense greatly if the settlers would work together instead of each going on his own account. At present the methods principally used in destroying the rabbits are poisoning and trapping; but the appointment of a chief inspector who will take in hand the compelling of the farmers to destroy rabbits found on their lands is urgently needed. At present a source of danger exists to the north of the No. 2 fence, where it has been definitely stated that rabbits have been found in several localities, that these may come down south inside the No. 2 fence, and I think that the immediate construction of a fence running west from Beedeinna to the coast is absolutely necessary to protect the agricultural districts; and it is quite possible that a second east-and-west fence may be found necessary, running through Watheroo, as was originally intended. The Public Works Department expect to have the fence completed somewhere about the end of the next financial year.

We are arranging to take over about 700 miles of completed fence from the Public Works Department early in the new financial year.

It has been found that camels are much more serviceable on many parts of the fence than horses, and I purchased 15 cow-camels, mostly in calf, and in a short time I hope we shall be able to breed all the camels we require instead of purchasing them.

The water service along the line has been greatly improved during the year, and is now quite equal to all demands, with one or two exceptions, which are being attended to. Small houses have been put up for the boundary riders between Burracoppin and Starvation Boat Harbour, and with much more comfortable quarters we should get a more satisfied staff of men, as under the old conditions they had a very rough time of it in the winter months; other houses are about being erected north of the railway line.

I have, etc.,

ALEX. CRAWFORD,

Acting Under Secretary for Agriculture.

Report of the Director of Agriculture.

For the information of the Hon. the Minister for Agriculture, I submit a report dealing mainly with the agricultural resources of the State, and the nature of future operations calculated to improve the producing capacity of the country. As the financial year ending 30th June was approaching its close when I assumed office as Director of Agriculture on 1st May last, there is the work of two months only which, so far as relates to last year's report, comes within my *régime*. The Acting Director's reports deals practically with the whole of the work for the previous year; hence I shall confine myself to some observations relative to the rural problems which beset us in this country, unique in geological feature, climate, and soil.

Rotation of Crops.

In travelling through the agricultural districts of the State, the student in rural economics is soon seized of the necessity of directing the tillers of the soil to the expediency of a combined or mixed method of farming. In this country, with its rainy months in winter and dry months through the summer, the question of rotation of crops, which by the nature of the case compels a change occasionally in the class of crops produced, would appear difficult of successful achievement. But the peculiar meteorological conditions of the country can be met to a great extent with more skilful manipulation of the soil by the farmer; and it is along this line our efforts should be directed. The rotation of crops is of vast importance to the State. It is a system that not only helps in the restoration of the soil constituents, but it fosters and encourages industries other than those pertaining to the mere production of cereals. For a few years past the area under cereals in the State has gradually increased, and from the yields obtained it has been made fully manifest that the country is admirably adapted to the growth of wheat, oats, and barley. Wheat and oats have been what may be termed the staple crops which, for obvious reasons, have been chiefly adopted. The good prices which have hitherto obtained for wheat, and wheaten and oaten hay, naturally led the farmers into the raising of these commodities almost solely; and so long as the good prices remained it was not expected that farmers would depart from the pursuance of an industry that paid them well. But the time is coming when, in the natural wake which the law of supply and demand follows, the value of cereals will be governed by the ruling rates in the world's markets. It is not to be taken for granted that the price of cereals will become too low to permit of profitable production on the immense areas adapted to their growth in this country, but it is evident that a better return could be obtained were a better system of stock breeding and dairying brought into play as a means of consuming many of the valuable by-products which now, under present methods, go to waste.

Experimental Farms.

The main agricultural areas of the State visited by the writer are those known as the South-West, Southern, Eastern, and Northern. In some of these districts there is probably some of the best land obtainable anywhere, but there is a lamentable lack of suitable pastures. In an endeavour to create a stimulus in this direction, the department has recently imported a variety of grasses with a view of experimenting to show which is likely to withstand the dry period of the year. While it may be impossible to get

any grass to stand to its wonted verdancy all the year round, it is practicable to have grass that may withdraw below the surface for only a short while, to again appear on the first solicitation of moisture.

The problems of production we can profitably study. We have learned by endless experimentation, and we must experiment further. The truth is not found ready to our hand. We must question nature, and learn by trials and failures. Experience is of course a dear school; too dear, perhaps, in some cases, especially where a farmer insists upon learning by his own experiences. One State farm can, however, experiment for the hundred or more farmers in that district; and this is where the value of a State farm comes in. But the State farm needs to be conducted on lines to meet what is demanded of it. Turning to the great work achieved in other countries which have taken up the question of fostering and promulgating agriculture, we may well ponder on the fact that we, in this practically virgin State, have an enormous amount of work to do—in fact, we have scarcely yet begun. Experimental work could certainly be carried out by individuals, but the magnitude of the task would appal most farmers. There are few men like the late Sir John Lawes, of Rothamstead, England, who established an experiment station at his own expense and worked out many intricate problems which have since been of inestimable benefit to his brother agriculturists. We may wait long in this age of commercialism and a scrambling for profit if we wait for the individual to carry out such work for us. We must help ourselves to lay upon the broad shoulders of society as a whole the work of experimenting in this State.

In discussing the experimental usefulness of a State farm, it must be borne in mind that it is not meant to convey the impression that the experiments should be conducted merely to show that it is practicable to produce certain crops in a given place. A State farm should show that it is possible to make farming pay in that locality. It should show that, under a well-defined system of farming, rotation of crops, and the attendant fodder production for stock, pays well. The sheep on the farm, the dairy herd, the poultry, swine, and the orchard forms the grand combination which makes farming a cash business; whereas when cereals are grown solely the cash returns come in but once a year.

Conservation of Fodder.

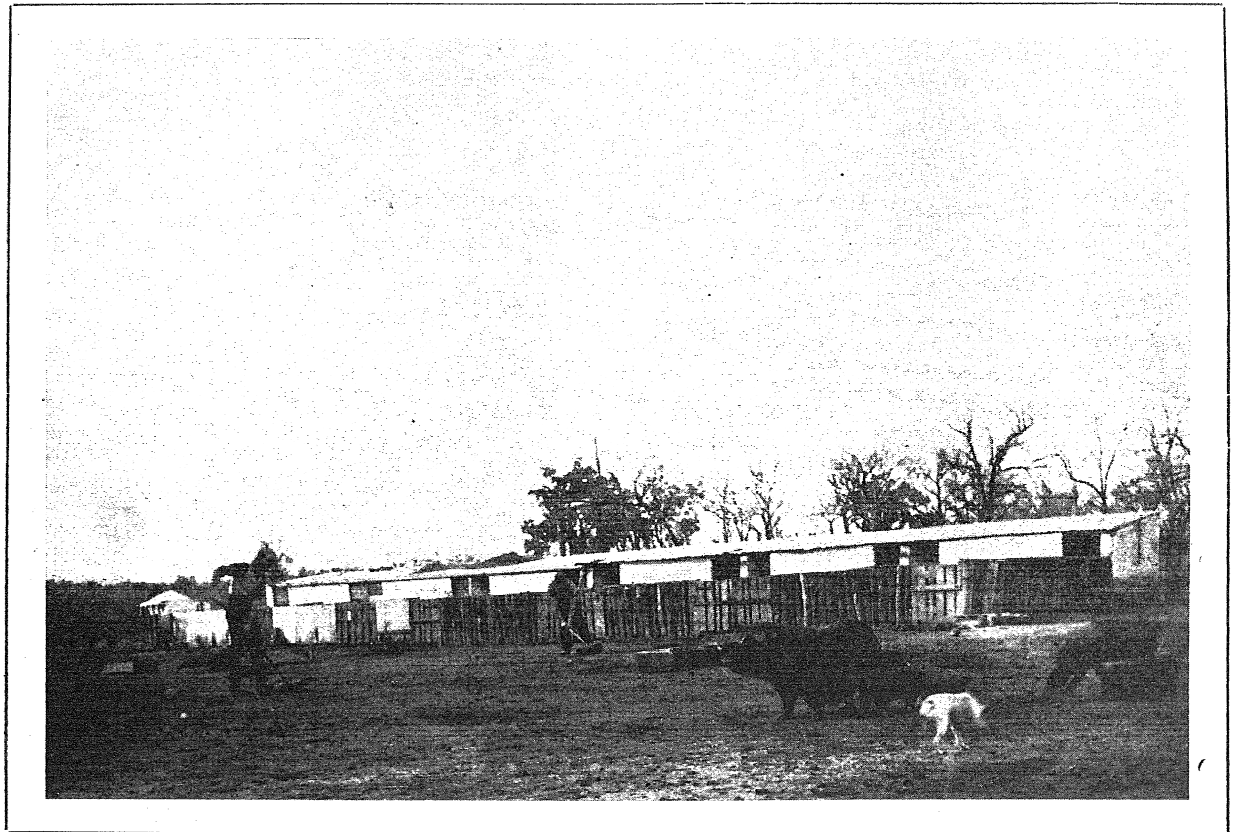
The conservation of suitable fodder to enable the dairy herds to be fed during the period when the dry weather smites the land is of great importance in the economy of the farm, especially when dairying enters prominently into it. To conserve sufficient fodder during the season of plenty the most reliable method is that of the silo. The practice of making ensilage has not been adopted generally in the State so far, and in this direction there is much to be taught the farmer. There is no subject that has been more persistently discussed than that relating to the silo and ensilage. It must not, however, be believed that the silo has been found to be absolutely necessary in every district in the different parts of the world where ensilage making has been carried on; but in a country such as we are dealing with, the uses of the silo in the conserving of food for stock are manifold. It would enable us to bridge over the period of scant pasture which is such an important feature in our farming operations. Silage by means of a stack can be cheaply made, but this method is recommended only when there is a superabundance of natural fodder. When the material has to be grown specially for the purpose, experience has shown that it pays

to have properly constructed silos to prevent waste. The exclusion of the air is the main consideration in making silage. The process is similar to that used in the preservation of canned fruits. When the temperature of the mass rises to 122 deg. F., owing to the pressure of its own weight, through its being put in the silo in a green or succulent state, the action of the ferment is arrested. When the available oxygen is exhausted chemical change ceases and sweet ensilage results. When any cause, such as an excess of moisture, prevents the temperature from rising to 122 degrees, the acid ferments will not be killed, and we obtain sour ensilage. This is not only less valuable than sweet ensilage, but there is more waste usually in making it. There is no silage, however, that may be said to be entirely free from acidity. There are many crops that could be produced in this country suitable for ensilage. Some grasses growing here, such as the *Lathyrus sylvestris* and the like, would make good ensilage.

Dairying.

There is no branch of husbandry that has come more into prominence in the principal progressive countries during the past few years than that of dairying. In all the Australian States, except Western Australia, dairying has forged ahead with a rapidity and comprehensiveness not a little remarkable. In New Zealand its progress has been marvellous; while in Queensland, a State which a few years ago was considered to be fit only for a sheep or cattle walk, the industry has gone forward to a degree which has surprised the most optimistic. The question is frequently asked: Can we pursue dairying in this State with the same profitable vigour as they have done in those places referred to? There is not any apparent reason why we cannot. The climate generally is excellent for dairy cattle; the only alleged drawback is the annual absence of suitable fodder. To overcome this, we must make provision in the manner described when referring to ensilage, and to make a strenuous effort to lay down good pastures. Feeding the cows requires more skill than most farmers are disposed to realise. A balanced ration of good feeds is necessary to the cow expected to give a good commercial return. A cow can be likened to a machine which is required to perform a certain amount of work when coerced with a definite propelling force. An amount of food commensurate with her capacity can be gauged, and the dairyman can therefore, if he carefully considers the matter, use his cow to the full extent of the profit that is in her. No dairy farmer who knows his business, as he ought to know it, would maintain a cow on valuable fodder unless he was convinced by means of the scales and Babcock tester that she showed a good credit balance after her feed was allowed for.

In order to create an incentive in the dairying industry in this State, the writer has already approached the Hon. the Minister with a view of obtaining the necessary grant towards the establishing of a State dairy farm. Where this farm is to be located has not yet been suggested. It should, however, be in the most suitable locality, irrespective of any special claims that may be advanced by any district. For this purpose a large area should be secured—not less, if possible, than between 3,000 and 5,000 acres, within a distance of five miles from a railway. An area such as described is necessary in view of future development (in addition to dairying) in the direction of poultry farming, pig raising, cultivatable land for the production of fodder crops, orchard, cattle pastures, stock breeding, etc.



Pig-sties at Narrogin Experimental Farm.

The practical value of such an institution is apparent in the fact of the State, which after all is only the aggregated settler personified, being then in a position to lead the van, and thus show the multitude the pecuniary advantage of the industry. The fact glares us in the face that we are sending away just under £400,000 annually for butter and cheese alone, and an effort should be made to retain this large sum of money in the State. The practical demonstration in the producing and conserving of fodder would be of immense value to the farmers generally, and it would not be surprising to see a large number of farmers embrace dairying when a concrete example of its value was given them.

This Department is being continually approached by farmers relative to obtaining dairy cows of the most approved milking strains. With such an institution as a State Dairy Farm, cattle of the right kind could be bred and distributed to those desirous of embarking in the business and a good class of dairy cow thus established in the State. It would be necessary to erect a butter factory on the farm at the outset; and to keep up a fairly good supply of milk for the factory—which need not be of too great a capacity at the start—between 200 and 300 cows would be required. The neighbouring farmers would no doubt become suppliers gradually, and by these means we would soon begin to show an increased output. The cows would have to be imported from the Eastern States; young animals only would be recognised. Many young men who are arriving here from Great Britain ask whether we have facilities for teaching them dairying; and in this regard the State Dairy Farm would be a further inducement to these young men to become dairy farmers and thus add to the producing power of the State. Accommodation would have to be provided for students at the farm; and in this manner it would become a useful institution—a valuable medium through which practical information could be disseminated to the prospective farmer and those already on the land.

Soil Inoculation.

The fixation of free nitrogen in the soil by means of organisms, and the results that have accrued have been brought prominently before the people of the State by Professor Bottomley recently. Although the Professor did good work in directing attention to the wonderful influence these bacteria have in propagating plant life by means of their nitrogen-fixing properties, this Department has for some time past been operating with the bacteria, the first consignment being sent out by the Agent General (Mr. Walter James). We have also been in communication with the United States Department of Agriculture and Dr. Moore, to whose untiring efforts are due the improved methods in making the cultures, and increasing by growth in non-nitrogenous media the nitrogen-fixing power of the organisms, and perfecting a method of drying them by which their activity can be preserved indefinitely. Dr. Moore is Physiologist in charge of the Laboratory of Plant Physiology, United States Department of Agriculture. Dr. Moore, in a treatise on the "Soil Inoculation for Legumes," refers to the fact that "scientific men have realised the tremendous importance of conserving the world's store of nitrogen, and have made every effort either to husband or to increase all available sources of supply. In the early days, when it was first realised that nitrogen was so essential to plant life—in fact was at the very foundation of agriculture—no particular alarm was felt. Botanists had demonstrated that plants obtained their carbon from the carbon dioxide of the air, and since this gas is present in so much less quantity than nitrogen,

it was believed that by no means could the most essential of plant foods be exhausted. When it was shown that plants were unable to use free nitrogen, and must obtain it directly from the soil in a highly organised form, the importance of the problem increased greatly, and the gravest consequences were predicted by those familiar with the rapidity with which this valuable element was being wasted."

When we reflect upon the statement made by the great chemist, Lieberg, fifty years ago, we can realise the seriousness of the world's supply of nitrogen becoming exhausted. He said that "Nothing will more certainly bring about the ruin of England than the scarcity of fertilisers. It means the scarcity of food. It is impossible that such a sinful violation of the Divine laws of nature should for ever remain unpunished, and the time will probably come for England, sooner than for any other country, when, with all her wealth in gold, iron, and coal, she will be unable to buy the one-thousandth part of the food which she has during hundreds of years thrown recklessly away."

It is manifest, as Dr. Moore points out, that the constant cropping of land, especially under the methods of farming pursued in this country, prevents the return to the soil of a large and legitimate nitrogen supply. We have here a sufficient indication of the extent of the loss without considering the destruction of nitrogenous compounds by the denitrifying bacteria, the burning or exploding of nitrate of soda, and the leaching out of this and other salts which would be otherwise most valuable as fertilisers.

In the face of all this we have, unfortunately, the knowledge that the world's supply of two of the richest sources of nitrogen—guano and saltpetre —is being exhausted rapidly. Guano in many parts of the world has ceased to be important on account of its scarcity; while it is difficulty to obtain precise estimates as to the available amount of saltpetre. It is very certain at the rate of its present consumption, which is estimated at one billion tons per year, it cannot last for a very great length of time, some placing the limit at fifty years. When we consider these things it is obvious that we should take every care of any nitrogenous product in the shape of guano or other compounds which nature has provided on our shores.

There cannot be any doubt that the inoculation of the soil is an important move in this country; and towards that end the services of the Government Bacteriologist have been enlisted. From our laboratories we anticipate being enabled to "put up" the bacteria in such a form as to be readily applied by the ordinary farmer. The results, so far reported by those who have received the inoculated seeds from this Department, are of a most gratifying character. It is through the leguminous plants which the best results have been obtained; and there is no doubt that we shall perceive immense crops of cereals coming in the ordinary rotation after a crop of field peas or other legumes which had been treated with the bacteria. Dr. Moore further says that, since the desirability of introducing a leguminous crop into rotation seems to be of such importance, and the benefits to be obtained from a nodule-bearing plant are so evident, it is natural that every effort has been made to obtain crops which possess the power of using atmospheric nitrogen. It has been found, however, that although in a great many instances the organisms producing nodules are naturally abundant in the soil, and the mere planting of the legume seed is sufficient to produce a crop capable of fixing nitrogen, there are also some localities which are devoid of the necessary bacteria, and in such places the

leguminous crop is of no more benefit to the soil than corn or wheat, or other crops whose yield might be a greater source of revenue. Leguminous plants grown either for the purpose of enriching the soil or for the crop must, in order to be of the greatest benefit to the land and the plants, be provided with the nitrogen-fixing bacteria. It is believed that the artificial culture is the method most efficient, cheapest, and freest from all objectionable qualities. For these reasons, adds Dr. Moore, inoculation should always be practised under the following conditions:—

(1.) On poor land which has not previously grown legumes.

(2.) On land which, although planted to legumes, has not produced a crop, and the roots of which legumes, upon examination, fail to show the presence of nodules.

It is probable that good results will follow the artificial introduction of bacteria if—

(1.) The legumes to be planted belong to another group than that already cultivated upon the land.

(2.) The same crop is to be planted upon land which previously produced a yellow and sickly crop of legumes possessing nodules which, instead of being a benefit, acted as parasites.

If the conditions favour the trial, good results may be obtained from the use of pure cultures when—

(1.) The crop has already been planted, and gives evidence of failure due to the absence of bacteria in the soil.

(2.) A field which has previously grown good crops of legumes begins to give even a slight evidence that, all other conditions being the same, it is not producing the highest yield. This situation is the hardest to detect, because it depends upon a gradual loss of virulence of bacteria already in the soil, and the only way of being certain of this condition is to try inoculation and note results.

In some cases the inoculation of the soil is unnecessary. This can be easily seen where the crop is thriving, and little benefit can be expected from an additional inoculation. Of course the nodules may be of the parasitic kind, furnishing little or no nitrogen, or they may be insufficient in quantity, in which case the addition of fresh bacteria may produce beneficial results. A considerable number of reports have been received, Dr. Moore says, indicating that even with such universally distributed organisms as those occurring on cow peas and red clover, the artificial inoculation of an old field produced a notable increase, and there is every reason to believe that where the land contains bacteria of a less degree of virulence than those sent out in the department cultures, an inoculation is worth while. On the other hand, it should be remembered that many fields are thoroughly supplied with bacteria of the highest efficiency, and no additional supply, however abundant, will increase the yield. Inoculation would be of little benefit, if any, to a rich soil containing a large amount of available nitrogen. The nitrogen-fixing bacteria will not grow well under such conditions, and, being in an enfeebled stage, the plants are able to withstand their action. The earth, already supplied with a sufficient amount of nitrogen, the plants will draw upon this direct source and produce as abundantly as if provided with nodules. This condition, however, is very undesirable for leguminous crops, and they should not be grown upon such a piece of land unless poorer soil

cannot be obtained, or unless a legume is the most profitable crop in that region. The use of artificial cultures is pre-eminently designed for poor soil which it is desirable to bring into condition for producing some root or grain crop demanding large amounts of nitrogen. In the sandy soils of this State the use of these cultures may work a revelation, and our experiments in this direction should be of great interest and value.

Miscellaneous Production.

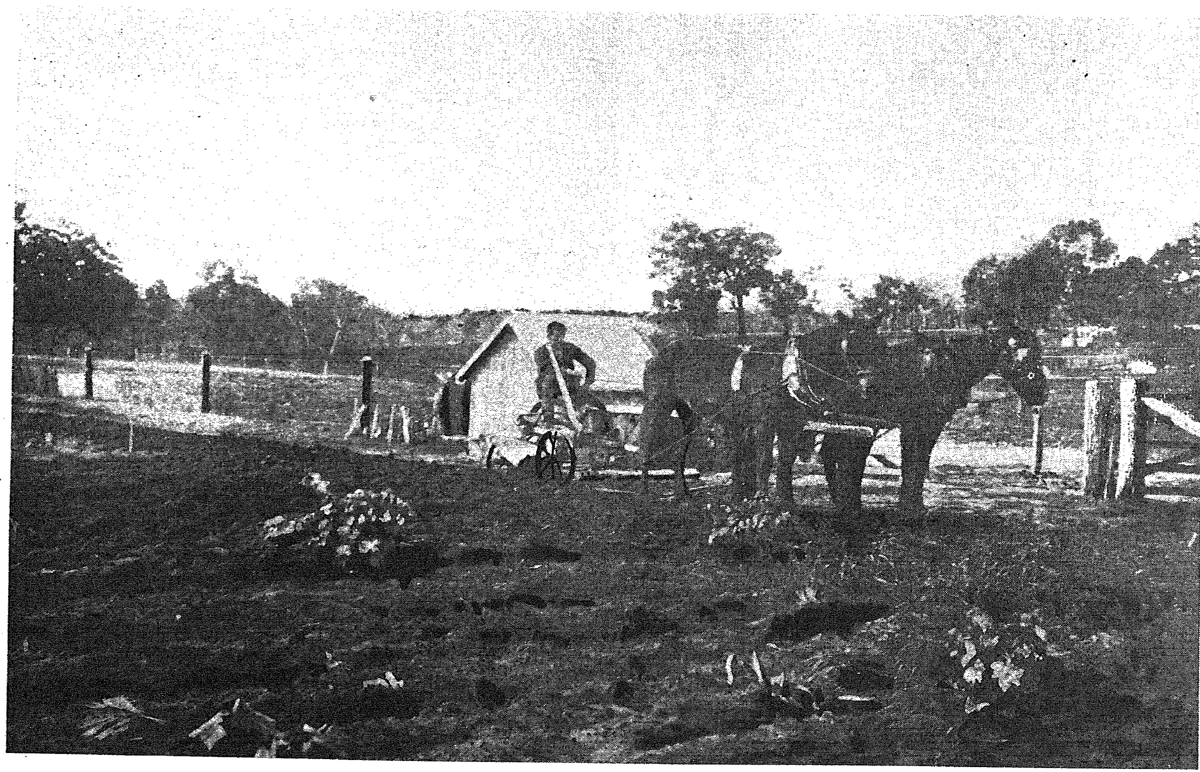
The wide range of latitude embraced by this State from its southern to its northern extremity provides natural facilities for the raising of almost any product the earth yields. The great length of coast-line has a varied climate, comprising that found in the temperate zone, where the English fruits flourish, to the humidity of the tropics. In this area it may be possible to produce many valuable commodities which have not yet been attempted in this State, and the writer suggests that during the next season some experiments should be made. The warmer and more humid parts of the country should be utilised with a view of raising such products as the world's markets now require. Among these products there may be mentioned rubber, coffee, arrowroot, chicory, cassava, pine-apples, rice, vanilla, fibre, cocoa, and many others of more or less value.

As an example of what we should be producing in this great tract of country, it may be of interest to draw attention to a few articles of commerce which are imported into the Commonwealth and which may well be raised here. The raw material for the manufacture of twine, ropes of all kinds, including marine cordage, is imported; and although Queensland has not as yet made any practical use of the fibres which the Kamerunga State Nursery at Cairns has shown to grow prolifically, it is evident on an inspection of the various fibre plants growing there, that an object lesson of much value has been set. As it is practicable to locate similar climatic conditions and soil in this State it may be as well to record a few of the results achieved at Cairns.

At Kamerunga the fibre-producing plants which grow luxuriantly are Sisal, Mauritius, Ramie, Manilla, and Kitool. Of these Manilla, being a species of banana (*Musa*), is particularly adapted to the tropics. The fibre from this is well known when manufactured into marine cordage. Then there is the sugar palm (*Arenga saccharifera*), a tree which must eventually become very valuable. This palm produces the fibre known commercially as kitool, which is used for making scrubbing brushes and brooms. It has remarkable power in resisting the action of water.

While at Cairns last year the writer made careful study of and noted the various products growing there, and from those notes these suggestions are made. The cocoa tree (*cacao*) is being encouraged commercially, and, considering the large quantity of this valuable material consumed, a profitable industry should be established in this alone. The trees grow vigorously at Cairns. It does not require costly machinery to prepare cocoa for market. The fruit, which is shaped like a large elongated lemon, simply needs washing and drying, and it is ready for market. The manufacturers then deal with it preparatory to its going out to the consumers. The yield per acre from a well established cocoa grove would be considerable.

The kola nut is an interesting tree, also doing well in the tropics. The fruit is becoming serviceable as a drug, its medicinal value being largely recognised. The product of the kola nut tree is even more valuable than cocoa.



Student working Three-furrow Plough at Narrogin.

Cinnamon, the bark of which is used largely for spices and confectionery, contains an essential oil of considerable value. The tree requires to be grown in large numbers for this purpose, but, as it can take care of itself, the cost of maintaining it is practically *nil.*

The Divi Divi is a large umbrageous tree, producing nuts useful for tanning purposes. The nuts from this tree are valued at £10 per ton on the plantation. They are also valuable in manufacture of khaki dye. The cultivation necessary for the maintenance of the Divi Divi is but little. The ground is cleaned up round the tree to receive the nuts which are shaken off, and then gathered for market. The yield of these nuts is extraordinary.

Considering the great demand for rubber, consequent on the many inventions which now call it into requisition, it is an industry that may well command the attention of the people in this State. The first of these trees to attract notice in the locality under review is the *ficus elastica,* a large spreading tree. It rarely seeds, and the plan of reproduction is by what is known as the goatee method. This is done by partly ringbarking a small shoot of the tree where it joins the parent stem, covering the wound with clay, and keeping it moist. Instead of the bark healing, roots are formed, which enables them to grow when subsequently removed to a nursery bed. The rubber is extracted from the tree by cutting through the outer bark with a gouge. A cup of clay is plastered to the tree to catch the latex, which is the white viscid substance containing the rubber. When left for a time it coagulates on the tree round the cup. It is then collected, at once washed, and then becomes marketable as raw rubber at from 2s. 10d. per lb. Each tree, according to its size, yields from 2s. 6d. worth of rubber to 20s. worth annually. Tapping for the latex is carried on at any time of the year except in wet weather.

An interesting rubber producer is *Tabernaemontana Crassa,* or West African rubber. This is a fairly large tree, which yields a fruit globular in shape, from 4in. to 5in. in diameter, and weighs from 1lb. to 2lb. It bears prolifically, and comes into bearing once a year after it has reached between two and three years old. Unfortunately it is the least valuable on account of its being waxy and difficult to treat.

Para (*Hevea Braziliensis*) is the best rubber known. It is now being largely grown in Ceylon, Southern India, Straits Settlement, and Java. The latex, which is obtained from the trunk of the tree, requires treatment in a store on the plantation. When mixed it is evaporated in pans, when it becomes biscuit rubber. It is then rolled, smoked, or otherwise dried, packed in lined cases, and sent to London, where it commands the highest price. It takes ten years to come to maturity. Para trees at the nursery at Cairns, five years old, are now producing seed and plants. *Castelloa Elastica,* or Central America rubber, takes six years to come to full bearing. This rubber is treated similarly to Para. It is fairly prolific, but it is not so valuable as Para.

Among other useful products which may be raised as an auxiliary to the ordinary farming in some of our Northern localities are spices of all kinds, tropical fruits, oils, resins, root and tree fodders, tanning products, dyes, drugs, and manurial trees and plants, such as *Erythrina Indica,* which acts the same as leguminous plants in supplying nitrogen to the soil. Some growers announce most satisfactory financial results in the production of such plants as vanilla. The vanilla (*V. Planifolia*) of commerce is so well known among culinary requisites that any reference to its use is unnecessary.

Under the shade of the natural forest the vanilla plant, when trained on a trellis or up the trunks of the trees, does well. Vanilla is worth from 5s. to 20s. per lb., according to quality. It bears the first crop in about 18 months from the time it is planted, and then bears annually. It requires but little attention, except when it is in the flowering season, when the blossom has to be pollinated by hand. Between eight and nine months elapse from the time of blossoming until the pods ripen. During that time the plants require no attention whatever. The mere fact of partial shade being essential to its growth prohibits the growth of weeds, and consequently materially reduces the cost of cultivation. Preparing the vanilla for market requires a little special knowledge, but this is easily acquired. The pods are simply gathered and treated, no expensive machinery being required. The plants can be set in practically uncleared land, the ordinary trees of the forest being used for the vines to climb up.

Tea, coffee, and cotton growing are industries that could be added to those enumerated, but in some instances the question of a sufficient supply of labour asserts itself. As regards sugar-growing, the labour necessary opens up a wide field for discussion, and in view of the large outlay in Central Mills which would need to be erected before any expansion of the sugar industry could be expected, sugar production cannot at this juncture be recommended. As an auxiliary crop, however, cotton could no doubt be successfully produced by the ordinary farmer. He could limit his area for cotton to meet the exigencies of the hired labour that may be available. Coffee as a collateral crop in mixed farming should pay well. A few acres of coffee trees could be attended to at odd times when the farm hands would otherwise be idle. The picking could be done by the same hands. Dried coffee will keep for any length of time; and there is, therefore, no necessity for immediate despatch to market, as with fruit. With mixed farming coffee permits, as before stated, ample time for attention to other matters. Poultry may run through the coffee plantation and do good. It fits in well with dairying and pig raising on account of the little attention it requires. With such essentially tropical products as fibres or cotton it would work well. Generally in mixed farming it would prove a remunerative item, owing to its keeping qualities, value per bulk, and very little variation in price. The gross returns per acre from coffee average about £35.

The success which has attended the cultivation of hops and flax in the South-Western portion of the State encourages the extension of the production of these valuable and highly remunerative commodities. During the forthcoming season the planting of hops, flax (phormium), sisal, hemp, and cotton will be recommended and assisted in suitable localities.

Stock-breeding.

In connection with the proposed State Dairy Farm, the question of general stock-breeding may be seriously considered. The difficulty in obtaining suitable army remounts has been made plain in the letter received recently from Colonel Hoad, Director General Army Remount Department, India. In view of this we could very well add horse-breeding to the other animal industries proposed to be started when the full arangements for the establishing of the State Dairy Farm are made. From what can be learned it is likely that we are losing an opportunity in this State regarding the breeding of suitable horses for the Indian market. The difficulty in obtaining the right class of horse for the army in India is, according to Colonel Hoad, due to the many inferior stallions that are being used, and that owners have

sold some of their best mares for export. The remedy suggested by Colonel Hoad is that a tax be placed on all stallions and that none be allowed to cover unless passed by a duly qualified official appointed by the Government. That the Government provide really good stallions, thoroughbreds, Clydesdales, Suffolks, and Welsh ponies for use by breeders at a nominal fee. This system, Colonel Hoad says, obtains in all the great horse-breeding countries in Europe. He has visited these countries for the Government of India, and has studied the systems in force there. An alternative would be, so as not to interfere with any private enterprise, that the Government give premiums to private individuals (as is done on a very small scale in England) who will stand approved stallions at a nominal fee for the use of breeders; and steps should be taken to prevent the best mares leaving the country. The Government of India takes between 3,000 and 4,000 horses annually for army purposes. Last year the Government took 4,000, and paid £45 per head for them landed in India. These horses, of the artillery classes, were the pick of the horses of that type bred in Australia, and, unfortunately, Colonel Hoad says, the class is rapidly decreasing. There is evidently a good market for horses of the right class in India, and it behoves us to make an effort obtain a share in it.

It is manifest that there is ample room to pursue stock-breeding generally in this State. For cattle, sheep, poultry, pigs, and horses the import value last year reached nearly £220,000. But then again we have to bring into our calculations the products of some of these classes of animals we had to pay for, which amounted to over £300,000, without reckoning the produce of the dairy cow, which amounted to just under £400,000. The imports of eggs and poultry show astounding figures, the value of eggs alone being given at over £80,000. In short the money sent away for produce of the soil, produce which could be raised in the State, amounted last year to £1,518,855. It is thus seen that we have a local market of some extent at present, and as time goes on the probable increase in population, due to the expansion of the mining industry, will meet the supply, increased in quantity by the number of additional farmers. It is noticeable that the production of wheat last year comes closer to local requirements. The wheat imported amounted to a value of £2,587, but the flour imported was valued at £85,813. It is interesting to note the steady advancement in the number of acres under wheat during the past ten years in this State; but the increased area during the past two years is worthy of special note, as it bears an evidence that the farmers are realising that a tremendous tract of country is suited to the growth of cereals. In the year 1894 the area under wheat was 21,433 acres, a falling off—due to the demand for hay—of just about one-half that of the previous year. Since 1894 the area gradually increased until it reached 137,946 acres in 1904, the acreage under hay being given as 109,002 acres.

Access Wanted.

Before any extensive expansion of the areas under cultivation can be expected, it is apparent that access must be given to our agricultural lands by means of railways. In some cases farmers are making a start at cereal growing 40 miles from a railway. When it is considered that the road freight for this distance is about 1s. per bushel for wheat, the pecuniary disadvantage the farmer labours under can be understood. In fact, he cannot compete on anything like even terms with his more fortunate neighbour who happens to be near the railway. In this State, which is now entering

upon its initiatory stages towards a general expansion of the agricultural industries, the question of "opening up" the lands suited to the purpose by means of railways is worthy of the attention of those concerned in our rural development. To put the matter plainly: If the land is not worth a railway to enable the producers to have access to the markets, it is not worth having for agriculture, although suited to grazing. As the railway is for the purpose of bringing into life the dormant productiveness of the land, the cost of that railway should be added to the land, such cost to spread over a number of years, the period being commensurate with the terms upon which the farmer receives his land.

As an example, we will say that a certain section of the country comprising Crown lands is suited to agricultural settlement, its length being, say, 100 miles. The maximum distance which a farmer should be from the railway is given at 15 miles. The area thus served by a single line of railway, allowing 15 miles on each side of it, would be nearly 2,000,000 acres. The cost of the 100 miles of railway would be at, say, £2,000 per mile, £200,000. To meet this and the interest we could add, say, 2s. 6d. per acre to the selling value of the land, which would be a small sum comparatively for the purchaser to pay when the instalments were distributed over 20 years. At the end of that term the capital involved in the construction of the railway would be wiped off; and it would then be in a position to convey the farmer's produce to market at the lowest possible rate, as there would not be any interest on capital to meet. The State would then receive back some value directly of the increment the railway had earned, and not permit it all to go into the pocket of the lucky selector whose property had been considerably enhanced in value by the State railway. Whatever improvement the construction of railways may make in regard to the value of our Crown lands, it is surely only fair business to demand that the lands pay for the cost of the machinery that so enhanced their value. In the event of the projected railways passing through lands already alienated, and which were necessarily benefited thereby, a similar contribution could be demanded by legislation from their owners. By these means we could place the railways in our agricultural districts on a business-like financial basis. The necessary capital could be borrowed for the construction of these lines on good terms, or the Credit Foncier method could be introduced. There cannot be any better security than the fertile lands of the State, and those with capital would feel doubly safe in such an investment. Such a scheme should be worth the consideration of our legislators. As the season was far advanced by the time I had a look round the agricultural districts of the State, I have not had the opportunity of giving effect to any practical suggestions which would have any material bearing on the operations of the farmers for the present year. I shall have, however, ample time to study any lines of improvement and give effect to them for the next season.

In my travels round the country it became obvious that in many places —in fact in quite a number of places—the maximum fertility of the soil is not being reached owing to the absence of lime and a proper system of drainage. It is my intention to introduce this subject *inter alia* into a series of lectures about to be undertaken in the various farming communities. Lantern slides have been prepared so as to give illustrative importance to the subject. In some localities it is believed that the yield of crops can be increased a hundredfold by lime and drainage. It is difficult to make the ordinary farmer understand that drainage increases the available moisture.

Some experiments made by King show that when the roots of the crop are forced to develop close to the surface the first effect is to exhaust the soil of its moisture so much as to leave it too dry and so lessen the capillary rise that, although there is abundance of water in the soil below, it cannot be brought to the roots, and the soil below is too wet to permit the roots to go to the moisture. On the other hand if the ground water is lowered the roots are permitted to advance deeper, making it unnecessary for the water to move up as high and leaving the soil more moist and the capillary action stronger and capable of lifting water higher and faster. By attention to these and other matters it may be possible to considerably enhance the productive capacity of large areas of the country already alienated and served by railways. This in itself should assist us in raising a greater percentage of these products for which we now send away such large sums of money annually.

C. F. CHAPLIN.

Report of the Chief Inspector of Stock.

TO THE DIRECTOR OF AGRICULTURE.

SIR,—I have the honour to submit my third Annual Report on the working of this section of the Department during the past twelve months.

STAFF.

With regard to the staff, no additions have been made with the exception of the appointment of a temporary officer in the Kimberley District to take the place of Inspector Haly, who has been removed farther south. The work of inspection has been carried out in a very satisfactory manner, and outbreaks of disease (which have been comparatively few during the year) have been successfully dealt with without any serious losses occurring. An amount was placed on last year's estimates for the services of an additional veterinary surgeon, as it was not anticipated that the work could be coped with by the then existing staff, and although the duties have been somewhat arduous where a call has been made for expert knowledge, they have up to the present been satisfactorily performed. However, on account of diseases which have always been present amongst stock in the Kimberleys (particularly amongst horses in the Nor'-West), it is now deemed advisable for a veterinary officer to be appointed to travel in these parts and investigate the various outbreaks, and at the same time recommend remedial measures. It is thought by these means the trouble could be considerably minimised, if not altogether removed. At the commencement of the year the work of the poultry expert was placed under my control, and the undertakings of that officer in the eradication of the poultry tick pest and the suppression of infectious diseases have been of a most appreciable nature. Particular attention has been devoted to the premises of dealers and the supervision of the various poultry markets, with a view of preventing the dissemination of the tick; and though considerable success has been attained, more stringent measures are being contemplated to demonstrate to those who are inclined to be apathetic the necessity of co-operating in the endeavours of the department to make the poultry industry a success in this State.

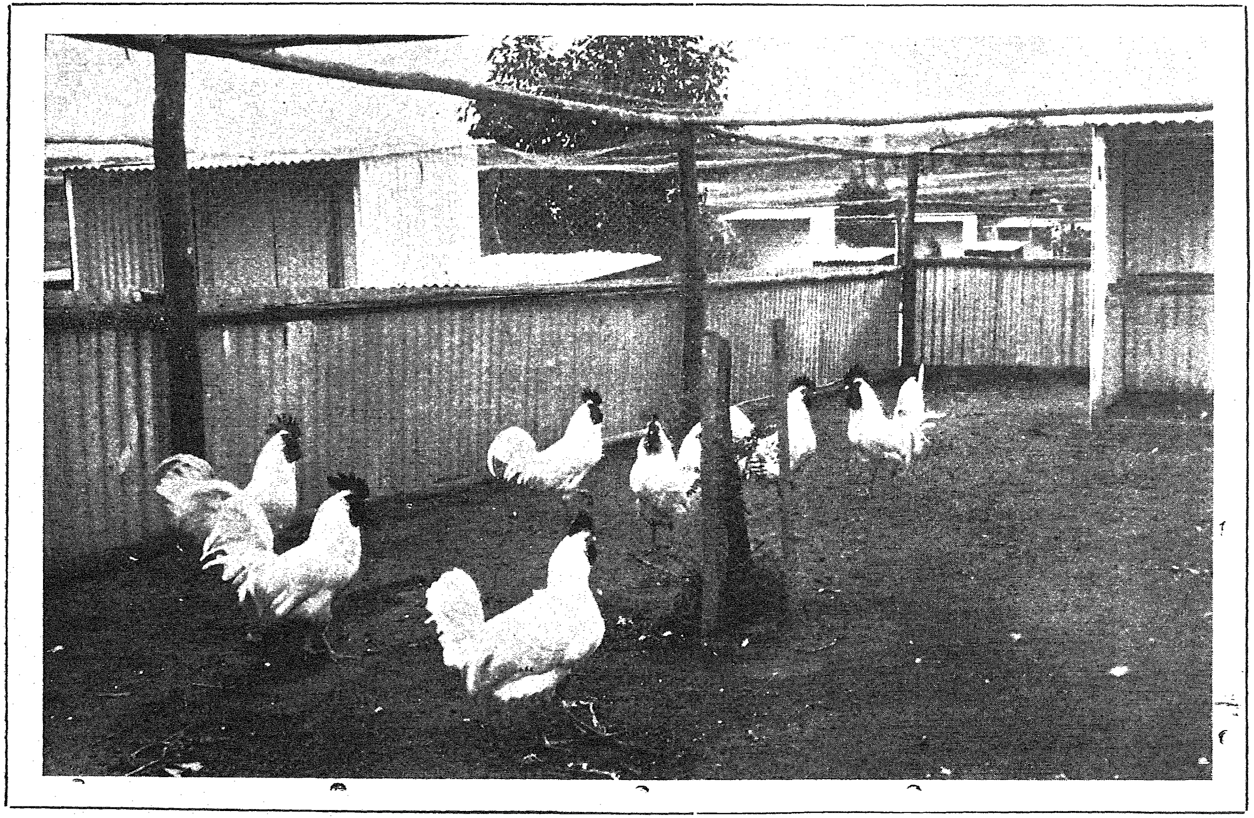
DISEASES, ETC.

Pleuro-Pneumonia.—This disease, has unfortunately, made its appearance in several quarters of the State, though now, with the exception of some latent cases which are continually occurring in the cattle shipped from East Kimberley, the country is more free from the disease than it has been for several years. With the exception of one or two instances in the suburban districts—one at Mingenew (Midland District) and another small outbreak at Serpentine—the losses have been small. With regard to the Kimberley outbreak, which was reported in November last, the latest reports favour the impression that the efforts made for its eradication are likely to be successful. The various herds where the disease was found were inoculated, and for the time being quarantined. With the commencement of the Kimberley shipping season, however, sundry latent cases already referred to became noticeable; but as every precaution has been taken to have the cattle confined on arrival here until slaughtered—or where they have been sent to the goldfields, also to be kept in isolated yards until slaughtered—the possibility of any infection arising from this source is very remote. Some breeders in the Kimberley districts have yet to realise that a more general system of inoculation against this disease is likely to prove of inestimable benefit; and should the disease again appear, compulsory inoculation will have to be resorted to, where it is ascertained that cattle-owners remain indifferent to its advantages; however, it is to be hoped that such a contingency will never arise.

Tuberculosis.—A few cases of this disease have been met with, and where the complaint has been generalised the affected animals have been promptly destroyed. The tuberculin test has been made, amongst many others, in order to determine the presence of the complaint. Satisfactory results have been achieved by bringing to light a few cases and determining the healthy state of the other subjects operated on.

Swine Fever.—Three supposed outbreaks of this disease were reported to the Department during the past 12 months, but on investigation it was found that the disease was not of such a serious character, and was diagnosed as an infectious form of pneumonia, resulting from insanitation and prevailing climatic conditions. The trouble was easily eradicated without any great loss occurring, and the reports from the various centres show that, with the exception of a few influenza cases, the piggeries are in a healthy condition. Despite the fact that no importations have taken place during the year except a few stud animals, an enormous increase of about 20,000 has occurred, which speaks well for the possibilities of the bacon-curing industry which has just been initiated.

Tick Fever.—Both the cattle shipped and the station herds in the East Kimberley district have been remarkably free from tick. This may be attributed to the dry season which has been experienced. A moist, humid atmosphere is necessary for the successful hatching of the young. Recent reports from the local inspector show that some of the more inland stations are now almost free from this pest, and it is possible that some of the higher and sparsely-grassed country will become permanently clean. The agreeable change thus resulting accounts for the almost entire absence of tick-fever and the good condition in which the cattle for slaughter are arriving. In consequence of the clean appearance of the cattle coming to hand the Department has sanctioned a more free distribution of these particular animals, with the result that general satis-



White Leghorn Cockerels at Narrogin.

faction is expressed for the privilege by those in the trade. It has now been conclusively proved that ticks can only hatch to any extent in these latitudes during a few summer months, and with the approach of winter they gradually disappear. It will thus be apparent that with the precautionary measures taken an even more free distribution could be allowed next year, and in this way minimise the congestion that has frequently taken place by the accumulation of stock which can only be shipped from the Nor'-West at one particular season of the year. Owing to the presence of pleuro-pneumonia in East Kimberley, cattle other than for slaughter have not been allowed out of the quarantine yards, and in consequence of this dipping operations have been suspended.

Poison Plants.—Owing to the many losses which stock-owners have suffered from the sundry poison plants common to the State, approval has been granted for this Department in conjunction with the Government Analyst and Bacteriologist to make investigations and ascertain, if possible, the nature of the poison, and recommend remedial measures which may be considered effective. Work of this nature should prove of scientific value, but the only effectual remedy for the landholder is to eradicate any poison plants found on his holding.

Horses.

It will be noticeable from the importation return that a considerable increase has taken place in this class of stock during the past 12 months. This applies more particularly to draughts, which are continually in demand, and command large values. The rearing of this class of animal, which is more successfully done by farmers, shows a very fair increase here; but a number of years must yet elapse before the supply can meet our requirements. With regard to lighter horses, a good local demand exists, and a profitable export trade could be done in cavalry and artillery horses. A large amount of suitable land for the propagation of this industry is to be found still unoccupied, and it appears a pity that it cannot be made useful for this purpose.

Cattle.

Owing to the dry season in both the Kimberleys the anticipated number of fats will not be realised, but the herds are reported to be in a very healthy condition, and the branding has every prospect of being an exceptionally large one. On account of the heavy losses which annually occur from tick-fever as the result of clean cattle within the tick area having to travel to Wyndham for shipment, the Government has approved of specified lots travelling *via* West Kimberley, and Stock Inspector Haly, to whom the work of inspection has been entrusted, advises that 697 head from Sturt Creek, the property of Messrs. Copley & Co., have been passed and are travelling to Derby for shipment; these should arrive here in specially good condition as they will not exhibit the consequences of having passed through the infected country. A good season is assured both on the Murchison and in the Midlands, and a plentiful supply of fats should be available when the Kimberley trade ceases. Our local dairy herds have been very free from disease during the past year, and a marked improvement is apparent as the result of greater attention being paid to the cultivation of green fodder during the summer months. This industry is making slow but steady growth within the State, and the South-West, which is particularly adapted to dairying, is showing signs of a brighter future.

Sheep.

This class of stock is reported to be very free from disease, only a few cases of ophthalmia and influenza having occurred. Tick and lice are slightly in evidence amongst some of the flocks in the South and South-Western districts, but these parasites are rapidly disappearing under compulsory dipping. The lambing season is now over, and the fall on the whole has been a very satisfactory one, though perhaps not quite up to the usual average in the East Murchison and Nor'-West inland districts. Shearing operations have started in the West Kimberley and Nor'-West, and the clip for the whole State promises to be a good one. The 1904 clip numbered 58,000 bales (approximately), and it is expected that this year's will total quite 70,000.

Pastures.

The considerable increase in stock has been the means of opening up some very good grazing country, though it would be as well to here point out that mistakes are frequently made in running the wrong class of stock to which the country selected is most suitable; *i.e.*, where sheep should be kept cattle have been obtained, and *vice versa*. Usually this is the case with new settlers who are not acquainted with the nature of the country, and in some instances severe pecuniary losses have occurred. The early rains have proved of great benefit throughout the State by giving the feed a good start and insuring the plentiful herbage for both ewes and lambs which is so essential at this time of the year.

Increase of Stock in the State.—In order to show the appreciable increase of stock which has taken place, I am quoting some figures from a comparative statement issued by the Registrar General:—

Year.	Horses.	Cattle.	Sheep.	Pigs.	Mules and Donkeys.	Goats.
1904	90,102	560,914	2,856,290	69,960	841	17,212
1903	82,747	497,617	2,600,633	50,209	600	14,120
Increase ...	7,355	63,297	255,657	19,751	241	3,092

General Remarks.

Brands Registration.—In August of last year the registration of brands, which had been previously executed by the Registrar General, was taken over by this department. A new Act came into force on the 1st of January of this year, under which a satisfactory system of registration has been inaugurated; and in compliance with the provisions of the Act, quarterly statements of registrations are being published in the *Government Gazette*, copies of which are being posted to all clerks of petty sessions and public poundkeepers in the State, whereby anyone wishing information of the brands in existence will be saved the trouble and time occasioned by applying to this office.

Construction of Abattoirs.—It was hoped that ere this the work of construction would have been well forward, but circumstances have arisen which have prevented this being entered upon as early as was anticipated. A superintendent has recently been appointed, who is already actively engaged with the plans and other preliminaries, and it is hoped that the work can be set in hand at an early date.

Financial.—The expenditure for the twelve months under the Stock Votes amounted to £6,060 8s. 5d., while the revenue collected by stock fees and brands' registration reached £1,336 15s. 8d., showing a balance of expenditure over revenue £4,753 12s. 9d., which is principally accounted for by the amount expended on the construction of the Wyndham Dip, viz., £2,150.

Stock Importations.—I am appending a small table which conveys some idea of the number of stock which has been imported and introduced for the year ending 30th June last:—

STOCK IMPORTATIONS.

Port of Landing.	Horses.	Fat Cattle.	Dairy Cows and Heifers.	Bulls.	Fat Sheep.	Ewes.	Rams.	Pigs.	Dogs.	Goats.	Donkeys.	Camels.
Fremantle	1,448	3,212	463	77	43,771	1,383	2,566	36	165	128	40	...
Albany	247	263	100	5	2,439	800	101	...	49	...	120	...
Geraldton	15	...	2	2	...	402	100	...	2	...	...	...
Eucla	...	256	...	1	92	...	...	15	3	...	71	150
Wyndham	809	3,940	...	...	...	...	...	...	...	...	...	...
Total ...	2,519	7,671	565	85	46,202	2,585	2,767	51	219	128	231	150

R. E. WEIR, M.R.C.V.S.,
Chief Inspector of Stock.

Annual Report of the Horticultural and Viticultural Expert.

TO THE DIRECTOR OF AGRICULTURE,

SIR,—I have the honour to submit the following report upon the work of the Horticultural Branch for the year ending 30th June, 1905:—

The progress which set in some 10 or 12 years ago continues without signs of abatement, as is testified by the steady increase of the area under orchard as well as the returns from the fruit trees planted in previous seasons.

That progress is also based on sound foundations, and the kind of fruit trees and vines planted may be said to be of the commercial class, the fruit of which is suited either for export and long keeping, for drying, or for manufacturing into wine.

So great has been the demand for trees for planting that the resources of the local nurseries have been taxed to their full capacity, and reference to the table showing the importation of nursery stock shows that nurseries outside the State supplemented the output of local nurseries by 134,930 trees and plants.

Fruit for Export.

The following kinds of trees are those most extensively raised and imported in response to the demand from growers:—

Apples—

Jonathan,	Dunn's Seedling,	Rymer,
Rome Beauty,	Stone Pippin,	Esopus Spitzenberg,
Cleopatra	Sturmer Pippin,	

all good for the local as well as for the export market. Varieties such as Scarlet Pearmain, the Scarlet Nonpareil, French Crab, which are extensively grown in Tasmania for the export market, are not favoured to the same extent in Western Australia, where late kinds, such as Rokewood and Shockley, come next in public estimation.

Pears—

Bartlett,	Vicar of Winkfield,	L'Inconnue,
Fertility,	Winter Nelis,	Keiffer's Hybrid.
Beurré Clairgeau	Josephine de Malines,	

All these kinds, picked at the proper period and packed and handled with due care, have proved good carriers whenever they have been subjected to an even, low temperature of about 34 to 35° F.

Next to apples and pears, oranges are most in demand, and amongst these the Washington Navel is an easy first. Although it is doubtful whether oranges as a class will prove a profitable article of export, there is every prospect of the Seedless Washington Navel meeting with a ready demand and bringing in good prices on European markets. Consignments must be landed in Europe between July and November, when supplies from the Mediterranean and the West Indies' ports, as well as from Florida and California, are not forthcoming.

Other varieties, also largely grown for both the local and the export markets, are Jaffa and Valencia Late.

Of other fruit, few would in the immediate future prove suitable for export, although, with improved methods of packing, swifter means of communication, and a lowering of the rates of cool storage freight, some kinds of grapes, Japanese plums, and prunes would prove good carriers and profitable fruit to grow for the larger oversea markets. Some kinds of persimmons would also lend themselves to long shipment, as they can be picked when still harsh and hard and long before they become soft and mellow and fit to eat.

In the course of conversation with the head of a firm in Paris which deals extensively in exotic products, it came as a surprise to me that some of their heaviest importations consisted of sweet potatoes, a particular yellow variety of which they procure in large quantities from Algeria, Malaga, and Virginia.

For well-dug sweet potatoes, case packed, the firm referred to tendered an offer of £10 a ton (f.o.b.), Fremantle, provided a reliable supply be assured.

Freight and Packages.

The fact that Western Australia is capable of producing fruit suitable for export in large quantities and of as good quality as any of the other Australian States where fruit culture ranks as an important industry has now been abundantly demonstrated.

York Gum Country at Chapman Experimental Farm.

But even the best of fruit, indifferently packed and carried at a high cost, will fail to prove profitable.

Our local market, eager to absorb anything produced from our farms and our orchards, has not yet impressed upon our growers the desirability and the necessity of methodically sorting and grading fruit offered for sale.

When we compare the present methods of packing, however, with the lack of method which obtained only a few years ago, when any kind of fruit—large, small, bruised, scaly, prime—all rattled together in second-hand cases of all shapes and sizes, and then sold for high prices at so much a dozen, it is evident that a revolution has since then set in as regards fruit packing.

At the same time, when it has become necessary for us to look abroad for the consumption of our surplus fruit crops, as important a revolution as marked the old time as contrasted with the new systems of packing will be needed, and more especially to Tasmania and to California we will have to look when improving our methods.

Of late some of the more progressive fruit-growers of this State have introduced, for the disposal of their crop, Tasmanian and Californian fruit packages. That new departure has proved profitable, and attention has been drawn to this subject by means of illustrations in the *Journal* of this Department, and also by means of addresses and practical occular demonstrations to farmers.

A number of inquiries made on this subject bear evidence of the importance which growers attach to careful packing in suitable packages. They find that it pays.

The experience of several years' fruit shipping has demonstrated that the measure of the profit of fruit shipments has been in the cost of freight and the quality of the cool storage provided.

Even now it costs as much for freight as it does to provide package and packing material, labour in connection with sorting, wrapping, packing, branding, carriage to port of shipment, wharfage and other port charges, insurance and London charges.

The following is a statement of cost of sending a case of fruit from a Tasmanian or Australian port to London:—

	s.	d.
Cost of case at the orchard	1	0
Wrapping paper and wood-wool	0	3
Sorting, packing, branding	0	6
Railway or river carriage to wharf	0	3
Port charges, shipping agency	0	3
Freight to London	3	2
Insurance	0	1
London charges	1	0
Total	6	6
Minimum cost of growing one case of apples ...	3	0
	9	6

This does not allow for shrinkage through decay, which cannot be overlooked, so that it is safe to consider that, in order to pay, a consignment of fruit to London must average at least 10s. a case.

The experience of shippers until recently has been that they have not, in the past, received at the hands of shipping companies that guarantee of the maintenance of a uniformly low temperature and of loss against pilfering which they have a right to expect. It is also felt that a further reduction in the cost of freight could be effected.

Cool storage freight, which a few years ago was 4s. a case, was only lately reduced to 3s. 8d.; and this year the Tasmanian shippers combined have secured a further reduction for the handling of the season's crop, and freight now stands as follow:—

	s.	d.	
Mail Companies, to London, 77s. 6d., less rebate 5s. at end of season	72	6	
or per ton of 23 cases ...	3	2	per case.
White Star, for Liverpool, 77s. 6d., less rebate 5s. at end of season	72	6	
or per ton of 23 cases ...	3	2	per case.
White Star, for London, 75s., less rebate 5s. at end of season	70	0	
or per ton of 23 cases ...	3	0¾	per case.

Introduction of Fruit Trees.

With the advance of settlement, evidence is every year adduced that distant and extensive areas which hitherto were considered incapable of growing fruit, have, under the test of experiment, proved their suitability for growing some kind of fruit.

Thus the citrus belt, which was supposed to occupy a fringe of the coast-line where the rainfall is both reliable and abundant, has been proved to widen very considerably as the warmer latitudes are approached.

From distant Nannine, 300 miles to the eastward of the port of Geraldton, as fine oranges are grown as are found in any of the best known orchards on the coast-line. It is probable that the altitude of the place, which is 1,400 feet above sea-level, mitigates the rigour of the climate, but the samples obtained from that region, where the annual rainfall is only 10 inches, speaks well for the capabilities of that part of the country wherever fresh water is tapped in the ground in sufficient quantity to supplement a scanty rainfall.

Indian Oranges.—To provide for such places as well also as for other localities better favoured as regards climate, some of the most noted Indian mandarin oranges were introduced some years ago.

Some of these trees have fruited this year, viz., the *Nagpur* and the *Suntolah.*

The other varieties imported directed from India, viz., the *Sylhet*, the *Kowla*, and the *Mussembi* have not borne fruit yet. There is no doubt but that some of these varieties will be welcomed by our fruitgrowers in lengthening the orange season and in proving of value in particular localities.

Smyrna and Capri Figs.—Amongst the fruits for which Western Australia excels is the fig. Wherever one goes, fig trees show by their luxuriant growth and by the quantity as well as the quality of the fruit they produce that they do here uncommonly well. One kind, however, and the most reputed of all, and one on which Turkey has established its supremacy in the fig trade, has not yet proved fruitful in Western Australia.

During the year, advantage was taken of Mr. Compére's visit to Asia Minor to procure plants or cuttings of the best drying fig of commerce, which, grown in the country around, is conveyed to Smyrna to be prepared for the over-sea market; and Mr. Compére was also commissioned to send at the same time plants or cuttings of the wild Capri figs, which harbour in their fruits the minuscule wasp which assists in fertilising the so-called Smyrna fig.

An investigation made on the spot, however, satisfied our Entomologist that there was some danger of introducing from that quarter a destructive leaf and bark disease of fungoid nature as well as a kind of scale insect we have not in Western Australia.

Instead, therefore, of procuring these figs from Asia Minor he waited until he could visit California, when, to Mr. Compére's order, this Department received last Easter an important consignment of fine young trees from the Faucher Creek Nursery, of Fresno. The consignment, which consists of "*Calymirna*," or true fig of commerce, plants, and two kinds of "*Capri*," or wild figs, which supplies the pollen necessary for the fertilisation of the staminate Smyrna fig, have been planted at De Hamel Experimental Station. When the trees begin to bear fruit, steps will be taken to introduce the fig wasp, through whose agency the pollen is carried from the one kind to the other, with the result that the Smyrna fig sets and matures its fruit.

Soon after the arrival of these fig trees a consignment of Capri figs, carrying the *Blastophaga* wasp, reached this Department by post. It was too early, though, to utilise the services of this useful insect, but an examination of figs, made by Mr. Lowe, the Assistant Entomologist, revealed the fact that the insects reached Perth in very good order, and stood the journey by post, extending over a period of six weeks, in a condition that leaves no doubt concerning their successful introduction as soon as ever their services are required.

Algerian Date Palms.—The recent introduction of these useful trees has already been made the subject of reports, which have been made public.

The British Consul at Algiers has interested himself to the procuring and forwarding of two collections of some of the best date palms in cultivation, and these, on landing, have been duly fumigated to guard against the introduction of possible insect pests, and subsequently distributed amongst public bodies as well as private individuals known to be willing to do all they can to establish the plants.

In due course these suckers, which have mostly been sent to localities possessed of an arid climate, will, it is hoped, prove prolific fruit-bearers as well as sucker-producers, from which supplies of plants will be secured for further distribution.

The kinds received are:—The "*Rhars*," which is extensively cultivated by both the Arabs and the French colonists of Algerian Sahara, a syrupy date of good quality. The tree is a rapid grower, fruits young, and matures its fruit early. It is one of the kinds I entertain great hopes from for our climate.

The "*Deglet Noor*," the choicest date I have ever tasted, and one of considerable repute. It does not fruit well in the sea climate of Algeria,

but does well in the trans-Atlas region, on the oasis of the chotts or extensive depressions which are met with around Biskra.

The "*Tedalla*," another good drying variety, early and vigorous, like the "*Rhars*." The fruit is of exceptionally large size. That variety is amongst the few transplanted with success from the arid M'zab country around Biskra to the valley of the Cheliff, situated between the Atlas and the sea. It is sufficiently early to mature its fruit during the rather short and relatively cool summer of that coastal region.

The "*Tedmanet*" and the "*Hamarea*," both early syrupy dates of good quality and susceptible of fruiting in less arid regions than the "*Deglet Noor*."

Cherries, of all orchard fruit, are the most disappointing in Western Australia, where, although growing luxuriantly and blossoming profusely, they have been proved to be notoriously bad setters. A number of reasons have been advanced for the failure of the cherry to fruit satisfactorily, by casual observers, and amongst others that of malformation of the flowering organs. I have no reason to believe that the trouble is due to that cause, although it is one which early suggested itself to me, and I have on a number of occasions closely examined blossoms from trees which do not bear as they should.

In the course of a round trip of investigations I made last spring through the district extending from Katanning to Kojonup and the Gordon River, I had pleasing evidence that many of the young trees planted seven to eight years ago are bearing crops which increase every year, and promise better for the future.

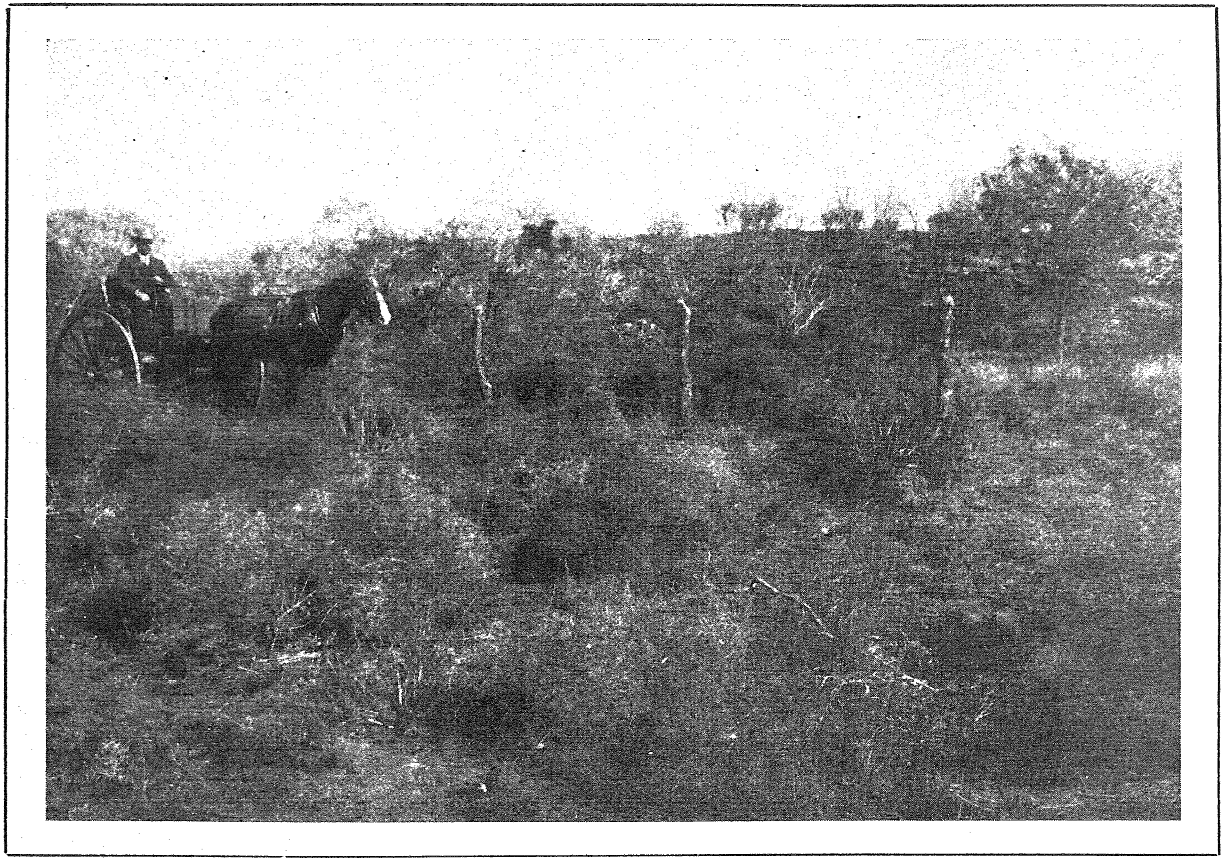
Of cherries alone, Western Australia imported, in 1903, 7,188 large crates of 56lb. each, and in 1904 we drew from the Eastern States 10,371 crates of cherries. In a previous report on this question I expressed the opinion that every single pound of cherries we consume we can grow ocally. That impression has, if anything, been strengthened by subsequent observations, although I would by all means caution growers from undertaking sterile, probably, experiments in localities that have already proved little suited to cherry culture.

With the view of testing a number of varieties of cherries under like conditions, the Hon. the Minister has approved of an experimental cherry plot being established at the Narrogin State Farm, where the peculiarities of each individual kind will be noted, and suitable, as well as unsuitable, varieties will be singled out.

Experimental Orchard.

A frequent cause of non-success in fruit-growing with new settlers is that they have attempted to do personally what it should devolve on the State to undertake. Instead of growing fruit for profit they are unconsciously growing it for experiment.

In previous reports I have already urged the desirability of establishing an experimental orchard. One small orchard, it is true, has been planted in connection with the Narrogin State Farm. It will, no doubt, be productive of much good; but the policy of the State Farms is such as leaves no room for experimental work, and in the main that orchard has been planted with



Unimproved second-class country at Chapman Experimental Farm.

the idea of supplying suitable instruction to the students, as well as abundance of fruit; any surplus sold will be credited to the farm account.

At the Hamel an orchard of a different type has also been planted, and it promises to prove one of great value to fruit-growers. Conveniently situated in close proximity to a railway station it is easily accessible to visitors, and will prove useful for demonstrating what can be done under drainage and irrigation, associated with intense cultivation. The land, however, on which the trees are planted cannot be said to be representative of vast stretches of fruit land which this State offers for a number of kinds of trees; besides, the conditions are not of the best in respect to soil and air drainage, and, although a most useful orchard of its kind, it is not one which lends itself to development on a sufficiently large scale. In a previous report, when referring to this matter, I expressed the opinion that:—" Such an orchard should be fairly centrally situated so as to be of easy access by the majority of settlers in search of information, and it should be located in a climate and on soil well adapted for fruit-growing."

The selection of a suitable place should be made after careful consideration, irrespective of the more or less forceful endeavours from eligible districts to have it located in their midst. It should be started on a well thought out plan, and should find room for fruit-growing on commercial as well as on experimental lines.

Field Work.

During the year I have answered numerous calls from agricultural and horticultural associations to either judge at pruning competitions or at shows, and to give practical demonstrations in the field on winter and summer pruning and on grafting. I have also availed myself of the opportunities offered of meeting settlers in connection with these gatherings to give addresses, illustrated by means of lantern slides, on horticultural matters. I have, also, in answer to applications from intending fruit-growers, visited and examined sites of orchards and offered advice regarding kind of trees to plant and methods of culture.

I am able to bear testimony of the marked improvements which have taken place in regard to fruit and vine growing as compared with practices of some years ago, and it it reasonable to infer that much good is being done by these pruning contests and demonstrations in diffusing amongst a great many who are just making a start in growing orchards and vineyards a good deal of helpful and valuable information. Perhaps at pruning contests too much has been attempted to be done in the time available. A good deal of rush is at times inevitable in order to get through with the programme of the day, and were less attempted more thorough and instructive work would result.

Wine Industry.

The check which it was predicted wine-making would receive in this State when Western Australia was drawn into the Federal movement is unfortunately being felt.

With the gradual disappearance of the customs dues, greater efforts are being made by the Eastern wine merchants to force their goods on this market, and in order to compete on terms as even as possible with the local wines, prices are cut down to a limit which cannot leave much margin of profit.

In spite of this keen competition Western Australian wines of good repute, carefully made from selected varieties of grapes and sufficiently matured, continue to meet with a good demand. This speaks well for the produce of our vineyards.

Last vintage was the heaviest we have yet had. I am not aware that the amount of wine made has yet been published by the Statistical Department, but it is expected that that total will show a marked advance on previous vintages.

Apart from the unsettling result the gradual reduction of customs dues, according to the five years' sliding scale, is having on the wine industry, another privilege hitherto enjoyed by West Australian wines over imported ones is about to be withdrawn. The specially favourable railway tariff is about to be cancelled, and all wines carried at the same rate on the railways.

In the face of these disabilities, and considering that wine-making has been one of the hardest-hit local industries consequent upon the advent of Federation, wine-makers feel that their industry and their enterprise has been particularly penalised, and any measure calculated to foster their industry would, by renewing their confidence, lead to an expansion in the wine production of Western Australia, which has proved itself to be particularly well suited to vine-growing.

Probably no better incentive could be given to further vine-planting than by encouraging co-operative organisations for the purpose of making wine and distilling brandies. On this point I have nothing to take back from my opinion already expressed: "That in a new country where wine-making is an industry of recent date, and one which requires an amount of knowledge on the part of the growers, which many have not yet had the time, the leisure, or the means of acquiring, it is better that production, manufacture, and distribution should all run in different channels, so that each may receive the attention which is essential to success."

Purity should be a recognised guarantee of Australian wines. Unfortunately this essential has of late years been too much disregarded, and a concerted effort has recently been started in New South Wales and in Victoria to urge the Federal Government to introduce a Pure Wine Bill which will apply to all the States. West Australian wine-makers are all desirous that such a Bill should be passed so as to offer a safeguard to the consumer, both at home and abroad, concerning the purity of our wines.

For the last few years improved methods of wine fermentation have been followed in several of our wine cellars. They aim at neutralising the spread of all injurious bacteria in the fermenting grape-juice and at encouraging, on the other hand, the uninterrupted work of the beneficial germs of fermentation. Such methods, which are not called for in the cooler wine-making regions of the continent of Europe, are now, in the light of the more recent knowledge we possess of wine-making, being regarded as essential in warmer climates. The success which has attended the treatment of that wine according to these modern methods is decidedly encouraging.

An improvement is also noticeable at several vineyards in respect to wine-making machinery, and in tools and appliances tending to reduce the work done by hand, and to do that work more expeditiously and with greater efficiency.

Returns of Fruit imported into Western Australia, 1904-5.

—	Apples.	Pear.	Quince.	Apricots.	Peach.	Plum.	Cherries.	Loquats.	Orange.	Lemons.	Pomelo.	Bananas.	Pine-apple.	Passion Fruit.	Goose-berries.	Other Fruits.	Grand Total.
Albany	515	131	...	136	16	279	409	2	837	283	...	373	9	5	153	115	3,263
Esperance ...	3	1	...	...	...	...	...	...	3	1	...	...	...	...	...	...	10
Geraldton ...	...	...	...	...	...	..	...	...	...	...	2	...	...	...	. .	...	2
Fremantle ...	31,835	2,990	...	1,204	509½	8,742	9,962½	...	19,713	9,454	..	21,825	413	1,091½	1,816	219½	109,775
Totals for 1904-5	32,355	3,122	...	1,340	525½	9,021	10,371½	2	20,553	9,738	2	22,198	422	1,096½	1,969	334½	113,050
Totals for 1903-4	39,167¼	2,592	48	1,005½	668	16,846½	7,188	11	23,223¾	10,785	22	18,104	250	1,351¾	2,033	389	123,685½
Increase ...	...	529½	...	334½	...	...	3,183½	...	...	...	...	4,094	172	...	...	...	...
Decrease ...	6,812¼	...	48	...	142½	7,825½	...	9	2,670¾	1,017	20	...	...	255¼	64	54½	10,634½

Return of Fruit Trees and Ornamental Plants imported into Western Australia, 1904-5.

—	Apple.	Almond.	Apricot.	Cherry.	Fig.	Lemon.	Loquat.	Mulberry.	Nectarine.	Oranges.	Peach.	Pear.	Persimmon.	Plum.	Quince.	Small Fruits.	Ornamental.	All others.
Albany	14,203	178	445	445	203	38	...	82	429	48	637	1,106	...	961	188	2,264	425	130
Fremantle	23,130	1,067	4,628	960	774	729	359	1,177	917	11,690	8,926	9,449	237	6,671	910	1,515	31,139	8,869
Totals, 1904-5 ...	37,333	1,245	5,073	1,405	977	767	359	1,259	1,346	11,738	9,563	10,555	237	7,632	1,098	3,779	31,564	8,999
Totals, 1903-4 ...	49,109	780	6,334	783	1,334	2,159	928	2,196	1,996	39,449	16,350	9,401	201	10,623	103	18,351	37,800	4,945
Increase	...	465	...	622	...	...	...	...	...	...	...	1,154	36	...	995	...	...	4,054
Decrease	11,776	...	1,261	...	357	1,392	569	937	650	27,711	6,787	...	...	2,991	...	14,572	6,236	...

Stock Well at Chapman Experimental Farm.

Insect Pests Act.

Until Easter last I had the control of the administration of this Act, but on account of the close attention which that administration demands, and which my frequent visits to country places did not permit, it was found advisable to relieve me of that work and place it directly in the hands of the Chief Inspector.

Any new departure, however, regarding the treatment proposed to be enforced in combating pests is submitted to the Director for consideration and approval, after consultation between the Chief Inspector and myself.

The campaign against the San José Scale, the Fruit Fly, and the Codlin Moth has almost entirely occupied the attention of the inspectors under the Act, and it is recognised by orchardists throughout the State that good work has been done in that direction.

The estimated number of orchards now in Western Australia is close on 4,000, and the acreage under vines and fruit trees about 13,000 acres.

In 1903, after three consecutive annual inspections conducted with care, 67 out of 294 orchards having at one time or other been known to have been infected by the San José scale, were declared clean.

In 1904, although 68 fresh cases were reported infested by the inspectors, the number of orchards then under special treatment or under observation amounted to 297 only, or 7 per cent. of the total number of orchards in the State.

The number of infected trees, which in 1903 was 5,170, was in 1904 reduced to 4,170 trees, or an average of about 11 trees per orchard infested.

A vigorous campaign is being conducted this winter season against that pernicious insect, and there is every hope that, with continued care, it will soon be eradicated from the great majority of the orchards found infested.

Orchard Products imported during 1904.

The following table shows the nature, amount, value and country of origin—Commonwealth or foreign—of orchard products imported during the year, most of which could be produced locally:—

Countries whence imported.

Articles.	Commonwealth.		Foreign.		Total.	
	Quantities.	Values.	Quantities.	Values.	Quantities.	Values.
		£		£		£
Currants (dried)	11,228 lbs.	164	554,357 lbs.	4,616	565,585 lbs.	4,780
Dates do.	23,802 ,,	217	172,320 ,,	1,063	196,132 ,,	1,280
Raisins do.	232,222 ,,	3,325	188,150 ,,	2,113	420,372 ,,	5,438
Other Fruits (dried)	174,915 ,,	4,001	125,529 ,,	2,091	300,444 ,,	6,092
Vegetables do.	...	55	...	1,190	...	1,245
Preserved Fruits	...	25,736	...	10,127	...	35,863
Fresh Fruits and Vegetables ...	...	30,137	...	8,237	...	38,374
Jams and Jellies	4,725,225 lbs.	56,766	78,611 lbs.	1,442	4,803,836 lbs.	58,208
Lime-juice and other Fruit Juices	7,381 gals.	772	7,334 gals.	1,433	14,715 gals.	2,205
Almonds	95,185 lbs.	2,220	22,745 lbs.	855	117 930 lbs.	3,075
Plants and Trees	...	6,111	...	153	...	6,264
	...	129,594	...	33,320	...	162,814

THE CODLIN MOTH

has now, as far as we know, been stamped out of Western Australia, where two small outbreaks were, the year before last, reported in some gardens in Perth and Albany respectively.

Last year every useless pippin tree within the quarantined areas at the places named was destroyed, and all tall apple and pear trees within the same area were cut back to a height of about 8 or 10 feet; the trunks were bandaged, the freshly set fruit sprayed with the usual Paris green spray, and all fruit from these trees stripped early and destroyed. A careful watch was kept on all neighbouring gardens. In Perth, frequent and careful inspections failed to reveal the presence of any codlin moth at all. At Albany a few wormy fruits were discovered in two gardens only.

This coming season the same treatment will be pursued, and there is every reason to anticipate that the steps taken have already proved efficacious in ridding this State of one of the most disastrous pests of the apple and the pear in the Eastern States of Australia and of Tasmania.

FRUIT FLIES

have again levied a heavy tax on the orchards of some parts of the country. The pest fortunately is by no means very widely distributed, and is troublesome more particularly in the vicinity of the Swan orchards and gardens.

Outbreaks beyond that area have almost in every instance been traced to the use by someone or other of second-hand fruit cases coming from infected sources.

ENTOMOLOGIST'S BRANCH.

During the year the work of this branch has been particularly interesting, as well as useful.

In July last, Mr. Alexander Crow, Deputy Commissioner of Horticulture of California, forwarded to this department, at the request of our Entomologist, Mr. George Compére, who had shortly before passed through San Francisco, a small oleander tree infected with "Black Scale" (*Lecanium oleæ*), parasitised by the small wasp (*Scutellista cyanea*), a very effective internal parasite of the above scale, introduced into California from the Cape Colony.

The plant came through in good condition, and the scales contained several healthy specimens of the parasite. Small colonies of these were liberated at Claremont, Perth, Guildford, and Gingin.

It is not definitely known yet whether these particular parasites have established themselves. Three other kinds though (two of the black scale itself and one which feeds alike on the black and on the soft brown scale) are actively at work against this scale, and are materially assisted by the *Orcus Australasiæ*, one of our most useful indigenous ladybirds.

About the middle of last year, Mr. Compére came back from Brazil, where he was successful in locating the home of the particular fruit fly (*Ceratitis capitata*) which for some years past has proved troublesome in some of our orchards.

From that trip he brought back two beneficial insects which prey on that fly's maggots. One a true internal parasite, the other a very active and voracious scavenger beetle of the *Staphylinidæ*.

On arrival these were liberated, but as it was then winter, when food is scarce for these insects, it is not known whether they have established themselves.

A fresh trip was therefore planned out, and Mr. Compére left in August last in quest of the codlin moth parasites he had been able to locate in the course of a previous visit to the South of Europe, and of a fresh colony of the fruit fly parasites.

The codlin moth parasites were required by the Californian fruit-growers. That State has, for the past two years, co-operated with Western Australia in utilising Mr. Compére's services as a collector of beneficial insects. The success of this expedition has been highly satisfactory, and advice from California conveys the information that 4,000 odd codlin moth parasites, the result of his search, were despatched by him, and arrived in San Francisco in splendid order. More than 30 colonies have since been sent out to various parts of that State.

On his way to the South of Europe, Mr Compére broke his journey at Port Said and proceeded to the Levant, where, from Jerusalem and Jaffa, he sent us a strong colony of a useful ladybird which feeds upon the red scale (*Aspidiotus aurantii*).

On arrival, the box containing these insects was opened with care, so as to guard against the escaping of parasites of that ladybird, and nothing but the full-grown beetles were liberated.

An examination of that orchard, made a couple of months ago, showed that, as a result of that introduction, the ladybirds had established themselves, and that the red scales had, to a great extent, been destroyed. The same success has, it is reported from California, attended the introduction of these ladybirds sent there at the same time by Mr. Compére.

The red scale is, unfortunately, in places the most serious pest orange growers have to contend with in Australia. In seasons it is to some extent kept in check by two local ladybirds, and the addition of a third one should help in ridding orchards of that pest.

Fruit Fly Parasites.

After having successfully introduced the codlin moth parasite into California, the Entomologist again set out for Brazil, early in March, and six weeks later, towards the end of April, news came from London that he had arrived with some parasites, as well as with an important lot of *Staphylinidæ*, or scavenger beetle, which in Brazil are most efficient destroyers of fruit fly larvæ, including those of the particular one which is known to us, as well also as those of four other species of fruit flies which attack oranges there.

These insects were procured from San Paulo and from Bahia farther north, and one of the most noted fruit districts of Brazil.

Whilst Mr. Compére was collecting these insects, steps were being taken at the Department to house them in an insectarium made insect proof, and provided with requisite ventilators, as well as with an electric radiator heating apparatus.

In this insectarium these insects were placed on the 25th May last, and were provided with abundance of fruit fly maggots. Of these, an enormous number were consumed, and it is beyond doubt that we have secured in

these scavenger beetles most searching and voracious allies in keeping down not only fruit fly maggots, but also maggots of the blowfly and of ferment flies.

Since they have been liberated in the insectarium, a number of larvæ of these *Staphylinidæ* beetles have pupated, and for that purpose they burrow an inch or so into the ground.

With the return of spring, colonies will be sent out to a few suitable gardens, where they will be kept in specially-constructed boxes, which also serve as receptacles for all wormy fruit. In this way it is expected to soon have for distribution numerous colonies of these scavenger beetles.

The internal parasite itself, from Brazil, does not promise to be as useful as these beetles, and an attempt will be made to introduce some fruit fly internal parasites from India, where they do a great deal of good work.

The Entomologist has once more started on a fresh mission, and is now on his way to China, whence some years ago he was successful enough in discovering internal parasites of the red scale.

After having secured these, it is arranged that he will endeavour to send on the Indian fruit fly parasites, and then parasites of the potato moth and the woolly aphis.

Fruit-eating Birds.

During the past year fruit-eating birds did little or no damage. In seasons when they happen to be in evidence, grapes and soft fruits almost exclusively are attacked. As a matter of fact, we have few fruit-eating birds in Western Australia, and, apart from "Silver Eyes," "Greenies," "Wattle Birds," and "Spiny-cheeked Honey-eater," which only appear in any number amongst the fruit crop every few years, we are singularly free from frugivorous birds such as parrots, parrokeets, minahs, leatherheads, and those introduced garden pests, the sparrow and the starling, which levy an ever-increasing tax on the orchards and vineyards of the Eastern States.

Concurrently with the notable absence of the "Silver Eyes" and "Greenies," the woolly aphis pest has been more in evidence on apple trees than it has for years past.

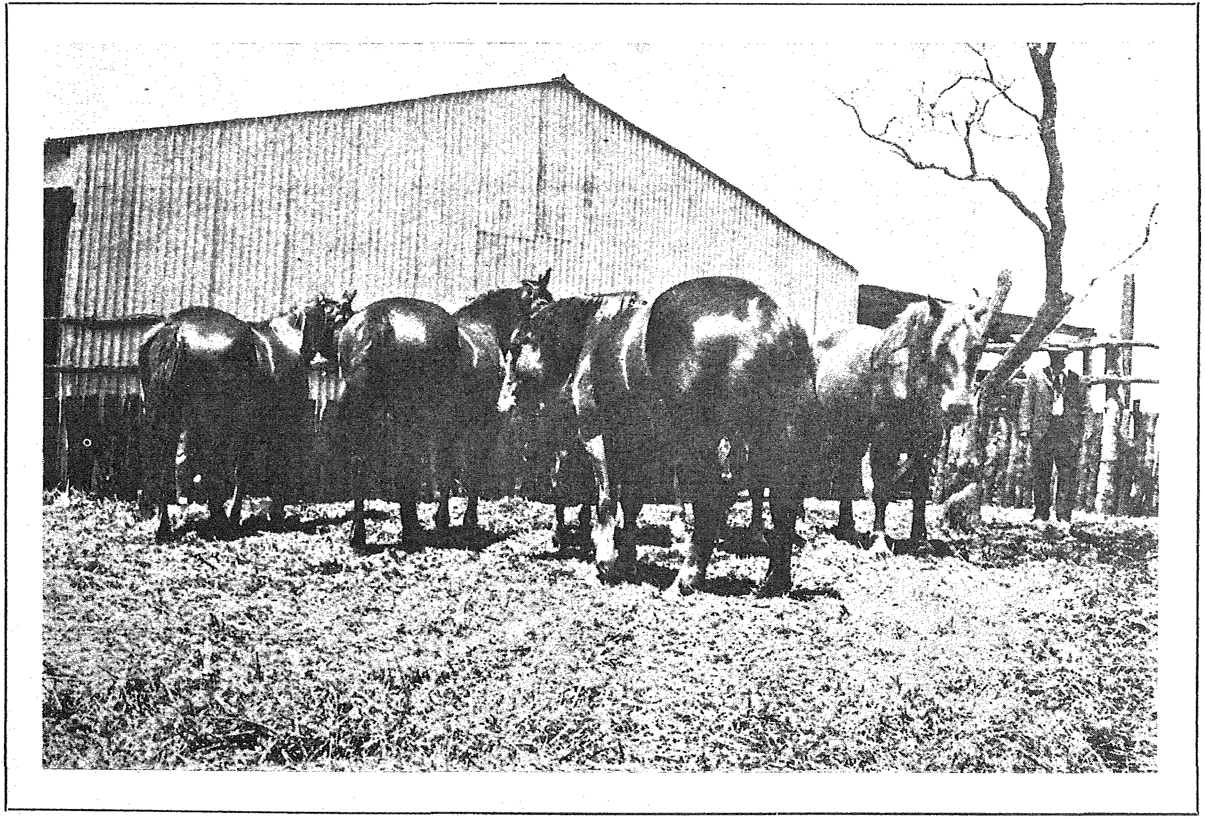
A systematic examination of the crops of fruit-eating birds right through the seasons of the year, conducted on species killed in as many districts as can be arranged, would throw some light on the quality and the source of supply of the food of these birds. A better understanding of their dietary would enable us to ascertain how far we can go in encouraging the destruction of these birds before the balance of nature is seriously disturbed.

Now that the services of the Assistant Entomologist are available, an investigation in this direction will supply data for coping with a pest which, although recurring at more or less distant periods, is nevertheless a serious one in certain seasons.

When in London, the Entomologist, Mr. Compére, recommended Mr. F. Lowe, who devoted many years to entomological work at the Natural History Museum, Kensington, for the newly-created post of Assistant Entomologist.

On the Assistant Entomologist now devolves the work of identification of insects and advising on matters relating to them.

To Mr. A. M. Lea, Government Entomologist of Tasmania, and once Government Entomologist of Western Australia, we are indebted for having



Imported Suffolk Mares, State Farm, Chapman.

hitherto, during Mr. Compére's absence and whenever called upon, readily assisted in advising us on entomological matters.

Since his arrival, Mr. Lowe has made himself acquainted with our agricultural districts, and the knowledge thus gained will be helpful to him in dealing with many of the entomological problems which now and again force themselves on our attention.

A. Despeissis, M.R.A.C.

PRIZE GARDENS ON THE GOLDFIELDS.

Report by the Horticultural and Viticultural Expert of the Agricultural Department of W.A. in reference to the Awarding of Prizes in connection with Competition inaugurated by the Goldfields Water Supply Administration.

After a careful examination of the gardens entered in the Goldfields competition for the prize offered by the Goldfields Water Supply Administration, I have also gone carefully into the merits of each, as shown in the notes which I took whilst engaged in judging, and now beg to submit my awards.

Class A comprises gardens of an annual assessed value of over £50.

Class B, those gardens of an annual assessed value of under £50.

Two prizes are offered under class "A," and entries under that class came from Kalgoorlie, Boulder, and Kanowna.

Under class "B" a first and a second prize are offered for each of the centres of Kalgoorlie, Boulder, Kanowna, and Coolgardie.

My recommendations are Class "A," prize and trophy:—

Mr. S. Hocking, Piccadilly Street, Kalgoorlie.
2nd prize: Mr. J. Brennan, "Castlecomer," Ward Street.

Class "B," Kalgoorlie:—

1st prize: Mr. S. Weston, Campbell Street.
2nd ,, Mr. M. W. Bawden, Piccadilly Street.

Boulder:—

1st prize: Mr. F. A. Liebig, Burt Street.
2nd ,, Mr. P. Dawson, Vivian Street.

Kanowna:—

1st prize: Mr. L. Ogilvie, Mercer Street.
2nd ,, Mr. A. Norton, Isabella Street.

Coolgardie:—

1st prize: Mrs. R. Walker, King Street.
2nd ,, Mrs. Powell, Piesse Street.

Special prize:—

Mr. A. H. Albert, "Windermere," Ward Street, Kalgoorlie.
Mrs. Jane Pippin, Coolgardie.

For competition under Class "A" seven entries were visited, viz., five in Kalgoorlie, one at Boulder City, and one at Kanowna.

Under "B" class the following number of entries was submitted for competition:—

Kalgoorlie seventeen, Boulder City seven, Kanowna six, and Coolgardie nine.

In classifying the several entries with the view of recommending the awards, I have met with no small difficulty, and found it impracticable, at this early stage of gardening on the goldfields, to adopt a previously planned-out scale of points.

In arriving at the classification submitted, I have considered in the main the chief merit of the garden as a pleasant, picturesque, and ornamental annex to the home, and one intimately acquainted with the private life of the owner.

One account has been given to that part devoted to the growing of vegetables and fruits for the home consumption. One or two thrifty vegetable gardens and several promising (even under the severe climatic conditions) exceedingly fruitful gardens were visited, but they hardly realised the characteristics of what the home garden should aim at.

In order to recognise in a special manner the success which has crowned the efforts of the pioneer fruitgrowers on the goldfields, I take the liberty of recommending, for the favourable consideration of the Water Supply Administration, that special prizes (one for Kalgoorlie and one for Coolgardie) be awarded to the owners whose names appear in the list submitted above.

The advent of an abundant supply of fresh water on the goldfields, apart from the benefit it was anticipated it would procure, has also been the means of raising interest in gardening. It has demonstrated the practicability of successfully cultivating some kinds of fruit trees in that region; and during my visit I have had ample evidence of the possibilities of growing apricots, nectarines, peaches, the grape vine, the passion fruit, and tomatoes among other fruit.

Apart from the gardens entered for competition, which themselves afford an instructive object-lesson in that direction, I have satisfied myself that others who are making a business of fruit-growing are doing so with every prospect of seeing their venture crowned with success.

It is not my intention to load this report with an account of the results of observations I have been able to make in the discharge of my duties.

Before concluding, I shall be glad if you will accept for yourself, and for both Mr. McQueen and Mr. Gliddon, the resident engineers on the goldfields, the expression of my indebtedness for the arrangements made to enable me to promptly discharge my duties as judge, duties that have also been made light and pleasant by the readiness with which all information asked for has been given by the competitors themselves.

IN SEARCH OF PARASITES.

By G. COMPERE, Government Entomologist.

Herewith I beg to submit a brief report concerning my recent mission to China, and what was accomplished, and also what I expect to search for on my next mission to foreign countries.

My recent visit to China was principally to secure the parasites of the red scale *(Aspidiotus aurantii)*, a serious pest of the citrus trees in this State; and also the parasite of the purple scale *(Mytilaspis citricola)*, the most serious pest affecting the citrus orchards of California at the present time.

That the parasites of both the red and purple scale was to be obtained in China, was known to me for some time, having discovered them on a previous visit to that country.

In China it is a very difficult matter to find either red or purple scale, even in scattering numbers, on citrus trees, and it was only at some out-of-the-way places that a few infested palm or oleander plants containing live specimens of the scale could be found, and then seldom more than a single plant in any one locality. Every plant which was noticed to be even ever so slightly infested by either the red or purple scale was purchased from the owners for the sake of securing the parasites which the scale might contain.

To California I sent both the parasites of the purple and red scale; while to this State I brought with me the parasite of the red scale, and since I landed they have begun to issue nicely, and are being liberated on trees infested with red scale; and there is no good reason why they should not prove just as effectual in this State in controlling the red scale as in China. From California I have as yet received no return to show in what condition those sent there arrived in.*

While in China, I sent to this State three small pot plants which were infested with soft brown scale *(Lecanium hesperidum)*. The scale was noticed to be very heavily parasitised; and since my return these have begun to issue, and I find that they are two new species, and are being liberated on trees infested with their food scale, and should, in conjunction with the previously imported species, prove of value in ridding the orchards and gardens of this scale.

I also sent to the State, while in China, several species of aphis-feeding ladybirds, but only 11 specimens of two species reached here alive, and these were liberated upon aphis. Whether they become established in the State from these few specimens or not, remains to be seen; but should they get a start, they will be of great value in helping the other imported species in checking the outbreaks of these plant lice, of which there are many species in this State; and we cannot secure too many of these aphis-feeding beetles.

I also succeeded in bringing to the State three specimens of a new species *(Scutellista)* of parasite on the black scale *(Lecanium oleae)*. There

* As will be seen in the Editorial Notes in this issue, the parasites referred to arrived in California in first-class condition.—ED. *Journal.*

were two females and one male. These we liberated on black scale, and should they become established here from these three specimens, will be a good addition to the other imported forms which have become established and which are fast ridding the orchards of this troublesome scale.

It should be remembered that California, when that State imported *Scutellista cyanea* from South Africa, only received alive three specimens, and (the same as in our case) two females and one male, and from these three specimens millions of parasites were produced in less than one year.

It was not my intention when leaving here on my recent mission to return so soon; but I found that there was very little chance of sending the red scale parasites from China and have them arrive here alive; and in this I was not mistaken, for those which I had placed in the cool chamber of the steamer were all frozen, while those that I had cared for in my cabin came through in splendid condition.

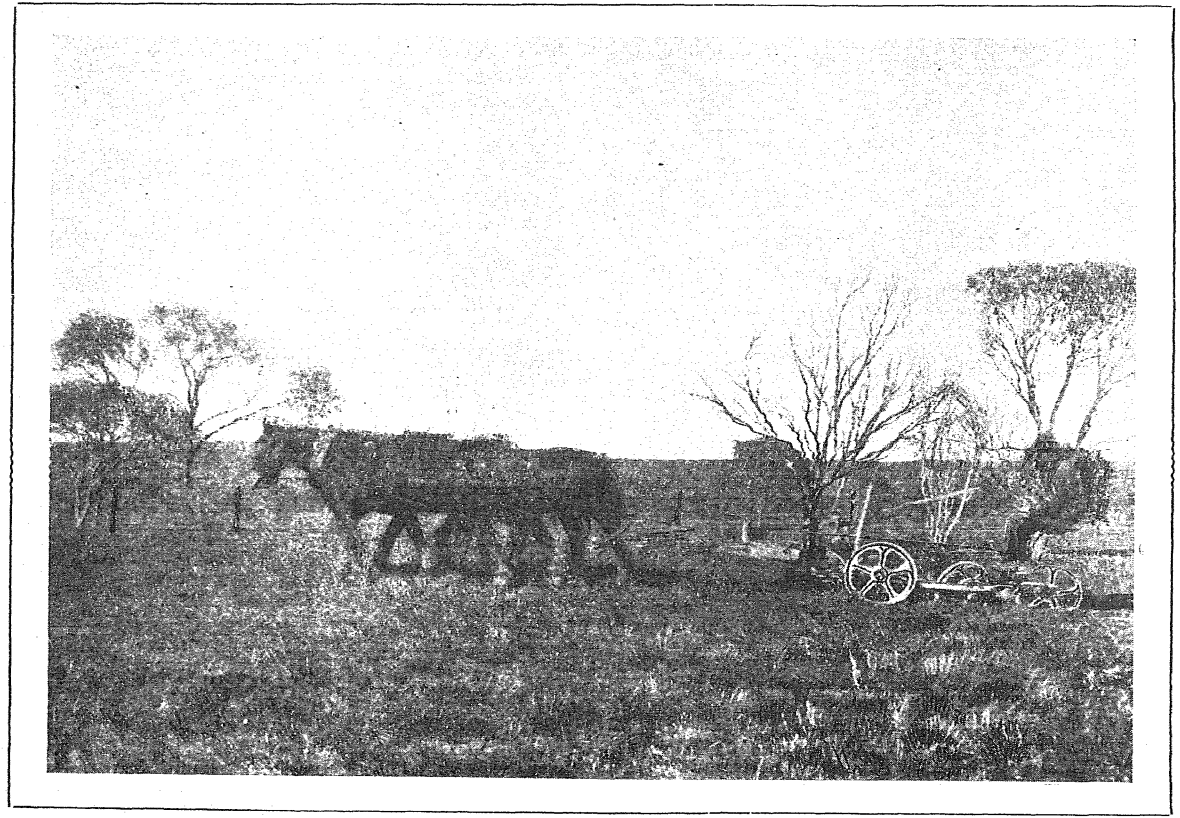
My next mission, on which I am about to start, will be chiefly devoted to searching for the natural enemies of the potato moth *(Lita solanella)*, which is such a serious pest of the potatoes in this State at the present time; and also those of the woolly aphis *(Schizoneura lanigera)*, and any other beneficial insects which I may meet with.

AUSTRALASIAN FRUIT TRADE.

Deputation to the Agents General.

A deputation of the members of the fruit trade of Hull waited on the Agents General for Australasia at the offices of the Hull Chamber of Commerce recently to discuss with them the question of the importation of fruit for Australasia.

Colonel White, speaking on behalf of the fruit-brokers in Hull, said they hoped to be able to satisfy the Agents General that there was a very large market to be found in Hull for fruit from Australasia, provided adequate and direct steamers were provided. Hull occupied a favourable geographical position for distribution, and he would like to point out that there were frequent and regular steamers plying between the port of Hull and Leith, Dundee, Aberdeen, Boston, Yarmouth, and other ports, to all of which merchants buying in the Hull sale-rooms sent large quantities of fruit. Then the Continental ports took very large quantities of fruit from Hull. Their geographical position, with regard to the sale of apples, put them out; more especially as Liverpool, having the fast passenger traffic, had better facilities for the importation of this fruit. Liverpool, with a total of 4,546,000 packages of hard fruits, had of apples alone 1,064,000. One million of these hard fruits to Liverpool were American apples. London, with a total of 3,368,000 packages, had 862,000 packages of apples, which



Student working Three-furrow Plough at Chapman Experimental Farm.

was not quite one-quarter of the total import, and of these 350,000 came from Australasia. Hull had only 720,000 packages of apples during last year.

Mr. Alfred Dobson (Agent General for Tasmania), in the course of his reply, said :—" Of course it is the object of all those who have the honour to represent Australian communities to find new markets. In Tasmania we are specially anxious to find markets for our fruit. The ports with which we do business at present are London and Liverpool, but from what I can gather from merchants in London and others, we seem to get a rather better price in London than when the fruits are sent to the provinces distributed through Liverpool. Then it is all a question, really, of the expenses which are incidental to the trade. I think the Hull trade really depends upon the freight and facilities for cheap distribution on this side of the world. If you can give us a good market, whereby our fruit-growers can make a fair profit, there is no doubt that thousands of acres would be broken up and planted with orchards, which is, in fact, already being done. The difficulty is that the fruit goes through so many hands that the unfortunate producer does not get the price he thinks he should have. The charge made by Covent Garden is 8d. per bushel, which includes dock dues, waterage, porterage, market dues, and warehousing. Then the question is whether cold storage steamers can be sent to the port of Hull; whether you have facilities for distributing this fruit throughout the very large population of which we heard last night, and throughout all these prosperous manufacturing cities. I think that if, by any means, you can reduce the expenses on fruit, and sell it at a cheaper rate, and provide the necessary accommodation for storage at times when the market is likely to be glutted, there is an unbounded future in this trade for both Australia and England. With regard to the German trade, we have been very anxious to do business with you in every department of trade, but, of course, we have to seek outlets with other countries. We have been very anxious to get direct trade with Germany, who, as you know, are a very enterprising people, and have a great advantage over English people through their steamship lines being subsidised by the Government. They are, I believe, building two steamers with refrigerating appliances for this trade alone. Your position is a very good one for foreign trade, and I do not see why some should not be done through the port of Hull by distributing it here in some way. If you encourage us to grow, the supply of apples will be so very great that it will be illimitable, and I certainly do not see why we should not ship pears, as some of those grown in Australia are really luscious. The prices, I think, you pay the grower are from about 3s. 6d. to 4s. a bushel. That would pay a man with a large orchard if he could sell his apples outright. First-class apples at Covent Garden sell from 10s. 6d. to 12s. 6d. a case, and for second-class from 9s. to 11s. After freight is paid, which is now 2s. 6d. a case, and the Covent Garden charges, which, as I told you, amount to about 8d. a bushel, the fruit brings from 10s. to 12s. 6d. in London. Of course, some very good apples will go up to 15s. or 18s., but sometimes it happens that there is a glut upon the market, and I am afraid that those who ought to look after our interests, either because there are no proper cool storage facilities or other reasons, do not place the apples on the market as judiciously as they ought to do; and I should think, to make the apple trade successful, you ought to have cool stores, so that if a steamer comes in with a large consignment of apples on board, you could put the fruit into the cold store, and sell when the market has recovered. At present, I am sorry to say, nothing of that obtains in Covent Garden."

Colonel White, on behalf of the deputation, thanked Mr. Dobson, and assured him that no efforts would be spared on their part to secure a large share of the trade. With regard to the cost of apples sent to Covent Garden, it was very heavy, and trade to Hull would be considerably less—a matter which the brokers would be pleased to put before the shippers when the time arrived. Their sale is by auction in Hull, which method they considered the best and readiest. With regard to cold storage, they had ample accommodation in Hull. So far as Spain was concerned, the brokers had their houses there in order that they might get into touch with shippers; and if the trade was important they would, no doubt, do the same in Australia.

EXAMINATION OF THE WESTERN AUSTRALIAN POISON PLANTS.

By E. A. Mann, Government Analyst and Chemist to the Department of Agriculture.

The Government Analyst and Chemist to the Department of Agriculture (Mr. E. A. Mann), in a report to the Director of Agriculture regarding his examination of poison plants, says:—

On 9th August, 1905, I was able to make a preliminary announcement with regard to the discovery of the poisonous principle of the York Road Poison Bush *(Gastrolobium calycinum)*.

Since that date the work has been followed up, and the chemical examination of this particular plant is practically finished, while others are in hand and their analyses well advanced.

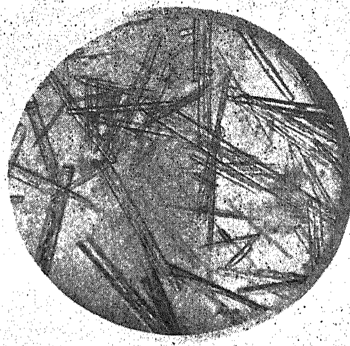
I now submit, therefore, a first progress report on the York Road plant in particular. Other progress reports will be issued from time to time as the work proceeds.

This initial investigation was naturally accompanied by special difficulties, but now that these have been overcome it will be much easier to examine other plants which may be submitted.

As you will see, a method of treatment by which the loss of stock can be reduced has been indicated, and will be put to practical test during the next few weeks.

Throughout the investigations I have had the invaluable help of Dr. W. H. Ince, who was specially engaged to assist me in this research, and I would like to again express my high appreciation of the skill and knowledge he has brought to bear upon the work.

This research has revealed some extremely interesting scientific facts, and the highly technical details, which are not suitable for a purely official



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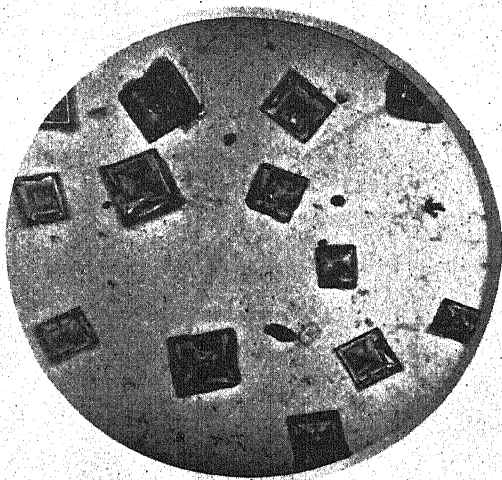

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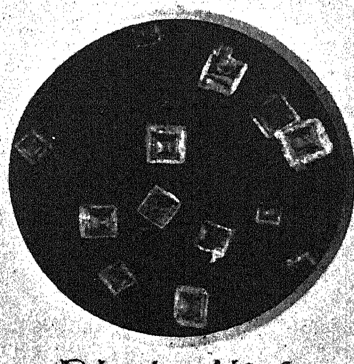

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report, are being communicated in a conjoint paper to one of the chemical societies in London through Sir William Ramsay, who has kindly expressed his willingness to assist me in any way.

The following is the first progress report:—

FIRST PROGRESS REPORT.

PART I.—GENERAL INTRODUCTION.

The State of Western Australia has for many years had an unenviable reputation by reason of the large numbers of indigenous plants which have, by their poisonous properties, caused heavy losses amongst cattle and other varieties of stock. Very shortly after the foundation of the colony, in 1829, the colonists made sorrowful acquaintance with these plants, and the early records (contained in private memoirs, diaries, and personal correspondence of the first settlers) abounded in reference to their troublesome character. Year by year enormous losses of stock have occurred through the animals eating these plants. At the present time the loss is estimated by the Agricultural Department at about £15,000 to £20,000 per annum. So great, indeed, has been the damage in this direction that the State has for many years looked upon its poison lands as such a poor asset that it has been content to practically give them away—the fee simple being granted for a mere nominal consideration on condition that the poison plants were eradicated within the space of 30 years.

One of the first comprehensive reports on these plants appears to have been made by Mr. James Drummond in 1842, who described several varieties and their properties; and thence onward references may be found from time to time, but generally these references are contained in documents not generally accessible.

In 1892, Mr. Bernard H. Woodward, Director of the Perth Museum, made an official report on the poison plants under the authority of the then Colonial Secretary, but dealt only with the botanical side of the inquiry.

In July, 1895, the West Australian Government Bureau of Agriculture proposed to initiate a full inquiry into the properties of these plants, and suggested that—

(1.) They should be botanically classified and described.

(2.) A veterinary surgeon should be asked to investigate their toxic properties and effects upon different animals.

(3.) That seeds should be sent to England, from which plants could be grown and analysed. (This suggestion was, apparently, not carried out.)

Experiments under the second heading were initiated in that year, the work being entrusted to Mr. H. H. Edwards as veterinary surgeon and Mr. S. S. Dougall as chemist.

The account of these experiments, as officially reviewed in the *Journal* of the Department of Agriculture of Western Australia, December, 1900, does not contain details of the chemical examinations made, but states that in March, 1896, Mr. Dougall reported that, as regards the "York Road" and "Box" poison plants, every effort to detect the presence of an alkaloid had been unsuccessful, but that he had found a glucoside or glucosides and an organic acid, either or both of which might be poisonous.

Mr. Edwards, from his experiments, thought that the acid found was the toxic agent, while the glucoside was inert. These latter experiments appear to have been made by hypodermic injections into animals of solutions prepared by Mr. Dougall. Results obtained clearly showed the plants to be highly poisonous, but the evidence was not conclusive enough to justify a decided opinion as to what constituent of the plant was the cause of the observed effects. Later experiments by these two gentlemen were also reported as unsatisfactory.

In 1897 an account of the native poison plants of the colony was prepared by the Government Botanist, Dr. Morrison, and published in Part III. of the *Settler's Guide*, published by the Government. In January, 1898, an excellent paper on the supposed poison plants of Western Australia was read before the Australian Association for the advancement of Science by F. Turner, F.L.S., F.R.H.S.; but this, again, dealt only with their botanical characters. In the same year another exhaustive paper was read by Dr. Morrison, Government Botanist, before the Müeller Botanic Society of Western Australia, of which, however, we have been unable to find any report outside the columns of the journalistic press. This also dealt chiefly with the botanical side of the question. In 1899, at the Intercolonial Medical Congress held at Melbourne, Dr. Rossilloty, of Western Australia, presented a "Note on the Poisonous Action of Species of Gastrolobium and Oxylobium," embodying apparently his own observations on the symptoms and post-mortem appearances caused by the administration of "York Road" and "Box" poison to animals.

The accounts of these symptoms given by different observers seem rather vague and discordant, the plants being variously described as "narcoto-irritant," "producing excitement," and "paralysing" in their effects.

Early in 1899 the West Australian Department of Agriculture sent specimens of three plants (the "York Road," "Box," and "Heart Leaf") to Professor Balfour at the Royal Botanic Gardens, Edinburgh, by whom they were forwarded to Professor Stockman of the University of Glasgow, for chemical examination. In September, 1900, Professor Stockman submitted a report of the results of his work (published in the *Journal of the Department of Agriculture, W.A.*, December, 1900), of which the following is a summary:—

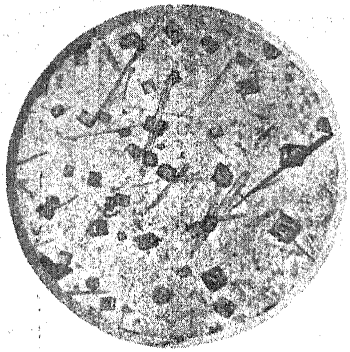
York Road.—When powdered, irritating effect on mucous membrane.

(2.) Extracted with boiling water, mucilaginous solution obtained containing gummy colloid body precipitated by strong alcohol. Non-toxic.

(3.) The alcohol water filtrate from the above, evaporated, gave brownish residue, which frothed abundantly with water, due to a substance of the saponin series "which is certainly the active principle of the leaves;" non-alkaloidal, but reduces Fehling's, and probably a glucoside. This could not be obtained in a purer state.

(4.) Extracted with alcohol, brown poisonous extract obtained.

(5.) Subcutaneous injections of these extracts in frogs acted as muscle poisons and killed in 24 hours. The action was local only, the muscles at a distance from the injection escaping. Heart became slow and weak. In rabbits large doses caused death. Doses given by the mouth, in neither animal had serious effects.



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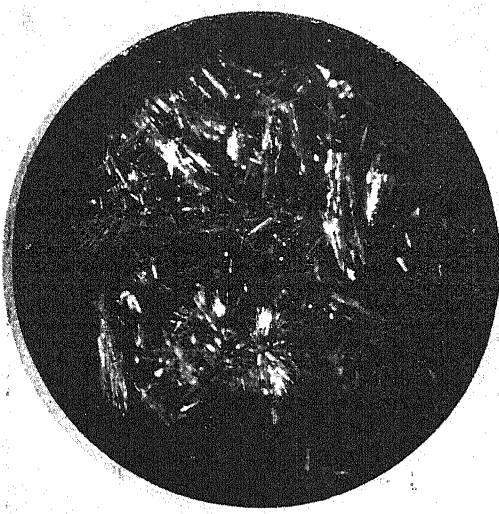

Photo N° 6

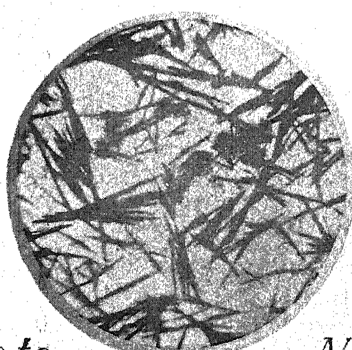

Photo N° 7

Box Poison.—Practically the same results as with "York Road."

The watery extract from 50 grammes of leaves failed to kill a rabbit. The position is evidently of the same nature as that in the "York Road" poison.

Heart Leaf.—No exhaustive examination was made.

A mucilaginous solution was obtained with water, as with the others.

In June and December, 1902, samples of several of these plants were again sent to England by the Department of Agriculture, and submitted to Professor Dunstan of the Imperial Institute for examination. A report was received this year (1905)* on one only of the plants (the "Narrow Leaf"), in which Professor Dunstan stated that by extraction with alcohol he obtained "a yellow crystalline substance, probably identical with or closely related to quercitrin, the glucoside found in the bark of *Quercus tinctoria*," but this possessed no toxic properties. Several other intractable amorphous resinous products were obtained, but up to the time of reporting, no evidence had apparently been obtained indicating that any of these bodies were of a toxic character, and no alkaloid had been detected.

As far as the work in this laboratory is concerned, the chemical investigation of these plants was begun by me in 1897, and was continued intermittently and, owing to pressure of official duties, at long intervals, for some years. In 1898, reactions of an alkaloid were obtained, and an extract prepared which had fatal effects when injected into a mouse; and again, in 1902, an extract was injected into a guinea-pig with fatal results. These investigations, however, though recorded in my annual reports, were too incomplete for publication. It is interesting, however, to note that these results were obtained by a method very similar to that which has since been employed with success.

In the present year the Government were approached and special facilities requested for making an exhaustive and systematic examination of these plants, with the result that the services of Dr. Ince were secured and the present collaboration was commenced in my laboratory in June last, with the results now to be detailed.

Before describing the chemical work carried out, it may be as well here, without going into botanical details, to give a brief description of these plants, as gathered from various published papers and from personal observation.

There are some fifty plants in all supposed to be more or less poisonous which are indigenous to this State.

They are derived from a wide area in the vegetable kingdom,† being members of a large number of natural orders including the *Leguminosæ*, *Solanaceæ*, *Lobeliaceæ*, *Myoporineæ*, *Euphorbiaceæ*, *Liliaceæ*, and others. Those among them, however, that confer distinction on this State as the unfortunate possessors of a particularly deadly series belong to the *Leguminosæ*. Almost all these are included within the limits of the sub-order *Papilionaceæ*. The genera *Oxylobium*, *Gastrolobium*, *Isotropis*, and *Gompholobium* all contain poisonous species—the first two including

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* Report addressed to the Director of Agriculture, Perth, by Professor W. R. Dunstan, F.R.S., dated 7th July, 1905. † *Vide* Dr. Morrison's paper read before the Müeller Botanic Society of W.A., 1898, and his article on poison plants published in Part III. of the *Settler's Guide*.

those which practically cause all the trouble amongst farmers and stock owners generally. The following is a list of these, giving their botanical as well as common names:—

Gastrolobium:—

(1.)	G. Bidens	"Breelya" poison
(2.)	G. Bilobum	"Heart Leaf" poison
(3.)	G. Callistachys	"Rock" poison
(4.)	G. Calycinum	"York Road" poison
(5.)	G. Grandiflorum	"Desert" poison
(6.)	G. Ovalifolium...	"Runner" poison
(7.)	G. Oxylobioides	
(8.)	G. Parvifolium	"Small-leaved" poison
(9.)	G. Spinosum	"Prickly" poison
(10.)	G. Trilobum	
(11.)	G. Truncatum	
(12.)	G. Villosum	

Oxylobium:—

(13.)	O. Capitatum	
(14.)	O. Cuneatum	"Wedge-leaved" poison
(15.)	O. Graniticum...	*
(16.)	O. Parviflorum	"Box" poison
(17.)	O. Retusum	"Bloom" poison

The above group of plants are those upon which we are at present engaged, and which we hope to systematically investigate, but in addition to these there are other species of leguminous plants believed to be poisonous, and there are several belonging to other botanical divisions to which we intend to direct our attention at the conclusion of the present work. The two most notable instances of these latter are what are known as "Blind Grass" and "Zamia Palm." The first (*Stypandra glauca*) belongs to the lily family, and the latter (*Macrozamia Fraseri*, one of the so-called Sago Palms) to the natural order *Cycadaceæ*.

It will be seen, therefore, that the field of research is a very wide one, though the close affinity of many of these plants may simplify the work if, as might be expected, it indicates a similarity in the poisonous principles which they contain.

Part II.—CHEMICAL EXAMINATION OF YORK ROAD POISON PLANT (*Gastrolobium Calycinium*).

The details of a chemical investigation of this kind are naturally of a very technical character, but in the following account I have endeavoured as far as possible to give a general idea of the work done, omitting purely technical details, which will be reserved for the scientific paper already referred to.

For an investigation of this description, the plant must first be broken down to a more or less fine powder, and here we met an initial difficulty. The plant is tough, and resisted the first attempts to grind it sufficiently small with mechanical cutters and mills worked by hand; but eventually, through the courtesy of Mr. R. McClure, manager of Messrs. Felton, Grimwade, and Bickford, Ltd., an electrically-driven disintegrator was placed at my disposal, which proved excellent for the purpose.

* There are several varieties of this species popularly believed to be distinct plants and known as "Sand Plain," "Narrow Leaf," and "Marlock" poisons, respectively.

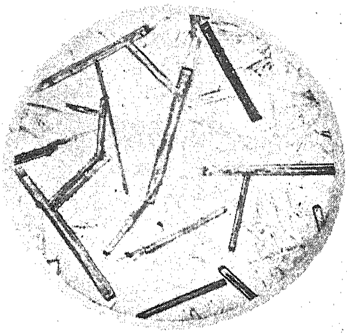


Photo N° 8

Photo N° 9

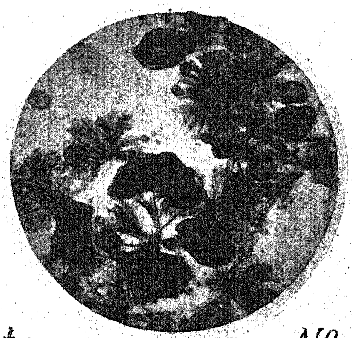


Photo N° 10

8. Ammonium Salt of Cygnie Acid x 625.

The next step, having obtained the plant in a coarse powder, was to find out to which class of organic bodies the poisonous principle belonged—alkaloid, glucoside, bitter principle, or otherwise.

To this end numerous experiments were made by treating portions of the material with various solvents to extract the poison, and applying a variety of tests to the purified extracts so obtained.

In these preliminary trials, evidence was obtained of the presence of a small quantity of an alkaloid.

The extractions were then repeated on a larger scale, with a view to obtaining this alkaloid in a pure state and investigating its properties.

The first result of this extraction on a large scale was—failure. A white crystalline substance was isolated which, from the method of treatment, should have consisted of a salt of the alkaloid sought for. It had, however, no physiological (toxic) action when injected into a guinea pig, and was proved to be, on further examination, not an alkaloid at all. As was subsequently proved, this substance was formed by decomposition of the alkaloid itself, the change being caused by overheating, etc., in the process of extraction. This body was, however, of great importance, and will be referred to again.

The experiments were then repeated, with the exercise of special precautions. Throughout the process the temperature was never allowed to exceed 100° F., and the extracts obtained were concentrated by evaporation in a vacuum pan.

This was a tedious business, as the extraction in the cold occupied two weeks and the subsequent evaporation three weeks.

The result was a crop of crystals which gave evidence of alkaloidal character, and possessed powerful toxic properties.

Therefore, a salt of a poisonous alkaloid, on which the main interest of the research depended, had been successfully isolated. (A photo. of this salt will be found at the end of this report.)

This alkaloid, which is new to science, has been named *Cygnine* (in honour of the Swan Settlement), and on analysis it was shown to have the composition $C_{19}H_{21}O_3N_2$.

It was thoroughly examined, and its gold salt was prepared in a pure state and analysed to confirm the composition.

The amount obtained was very small, and even by exercising every conceivable precaution the best extraction was only equivalent to 0·25 per cent. of the plant.

It is evident, therefore, that the poisonous principle exists in the plant in only a very small quantity, at any rate in that stage of growth at which my supply was cut.

The most striking characteristic of this new alkaloid is its extreme instability. It forms very few of the compounds generally obtained from other alkaloids, and readily undergoes radical change of composition when subjected to slightly-raised temperatures.

It then gives rise to cubical crystals of a body already referred to, of which the exact nature has not yet been determined. This readiness of decomposition, however, has given a valuable clue to a method of treating poisoned stock, which will be described later; and if this method of treatment

is successful, this very instability of the alkaloid may prove a most valuable property. In this case the first failure referred to above will prove to have been a real stepping-stone to success.

The unstable and consequently elusive character of cygnine has probably been the cause of the failure of other chemists to detect its presence.

Although the original aim of the investigation was the isolation and examination of the toxic principle of the plant, there were several other bodies to which attention was drawn as the work proceeded. As this particular plant was the first of a series, it was thought advisable to examine these substances more closely, and carry the investigations somewhat beyond the limits originally intended—with the following results:—

Alkaloids occur in plants in the form of salts, being combined with acids which are often peculiar to a particular alkaloid; for instance, morphine occurs in opium in composition with a particular acid called meconic acid.

By searching for the acid with which cygnine is combined in the York Road poison there was revealed an acid of the composition $C_{10}H_{11}O_4$, which is new to science, and which we have therefore called *Cygnic Acid*. It is probable therefore that in this case also there is this characteristic acid with which the alkaloid is combined.

The following bodies, also new, were likewise isolated from this plant, and have been analysed and named:—

Gastrolobic Acid ($C_7H_{12}O_6$), a dibasic seven-carbon acid, probably an oxidation product.

Gastrolobin ($C_6H_{10}O_5$), a vegetable gelatinoid or colloid.

Cygnose ($C_6H_{12}O_6$), a new sugar, optically inactive and non-fermentable.

Further description of these bodies is not necessary here. Some of them require further study, but I cannot say at present that any of them are of any special value beyond their scientific interest, though this is considerable.

The above is only a brief summary of six months' work into which were crowded many intricate investigations, but a tabular statement of the whole of the operations will be found in the key plan attached hereto.

I also forward herewith some excellent photos. taken with the microscope (for which I am greatly indebted to my assistant, Mr. T. N. Kirton), showing the forms of the different products obtained as follows:—

List of Photos.

Photo. 1.—Gastrolobium Calycinum ("York Road Poison")
Photo. 2.—Cygnine Hydrochloride x 625
Photo. 3.—Cubical crystals (transmitted light) x 625
Photo. 4.—Cubical crystals (reflected light) x 625
Photo. 5.—Cygnine Hydrochloride decomposing into cubical crystals x 75
Photo. 6.—Cygnine Aurochloride (reflected light) x 625
Photo. 7.—Cygnine Aurochloride (transmitted light) x 625
Photo. 8.—Ammonium Salt of Cygnic Acid x 625
Photo. 9.—Gastrolobic Acid x 625
Photo. 10.—Osazone of Cygnose x 625
Photo. 11.—Extraction Apparatus.

Gastrolobium Calycinum, "York Road Poison."

Gastrolobium Calycinum, the York Road poison plant. Nat. order: *Leguminosæ*. Sub. order: *Papilionaceæ*. Tribe: *Podalyniceæ*.—A glabrous erect scrub from one to three or four feet high, leaves opposite or in threes, rigid, lancet-shaped, with a pungent point, one to two inches long, stripules setaceous. Flowers large in pairs or threes along the axis of a raceme, each above a long large membranous bract; calyx five lines long, glabrous, the lobes rather longer than the tube, the two upper united to above the middle and rounded at the end; upper petal about three-quarter inches diam., lowermost deeply coloured, a little shorter than the lateral ones; pod on a very short stalk, containing two seeds.

[Botanical description kindly supplied by Dr. Morrison, Government Botanist.]

Part III.—PHYSIOLOGICAL.

Under this heading are included the tests which have been made as to the toxic properties of the alkaloid, and suggestions as to methods of treatment for poisoned stock.

During the course of the research the poisonous nature of the products obtained could of course only be established by life tests. By this means, as already described, one important point was established as to the nature of the cubical crystals obtained by the decomposition of cygnine.

With cygnine itself the following tests were made, with the assistance of Dr. Blackburne, and proved its toxic character:—

Test 1: 9th August, 1905.—$\frac{1}{10}$ grain of cygnine hydrochloride dissolved in a few minums of water, injected subcutaneously into a guinea pig, killed the animal, weighing 568 grammes, in seven minutes.

Test 2: 11th August, 1905.—$\frac{1}{20}$ grain similarly injected killed another guinea pig, weighing 348 grammes, in 22 minutes.

These doses were equivalent to 0·0087 grammes and 0·0094 grammes per kilogramme of body weight respectively.

With regard to the symptoms exhibited, the following is an extract from Dr. Blackburne's notes on the first experiment:—

"After remaining quiet for two or three minutes it appeared to become rigid with head stretched forward, then returned to normal, but in a minute or so rapid convulsions came on. The teeth could be heard to shut with a snap, the body became rigid, being thrown forward on the hind legs, but there was no obvious opisthotonos. These spasms occurred three or four times, and in between six and seven minutes from the time of injection of the poison the animal was dead.

"A *post-mortem* examination was immediately made. There was marked venous engorgement throughout the parenchymatous organs, and the lung and all the large veins were much dilated. There was no local reaction at the point of injection. The heart was greatly overfilled, every chamber being much distended with dark blood. One hour and a-half afterwards the heart (still *in situ*) responded to stimuli.

"Death was evidently due to asphyxia, probably secondary to the convulsions. It would appear from this that the poison belongs to that group of which the principal one is strychnine. One of the belladonna group might indeed have set up convulsions and also cause the heart to cease in diastole, but is not likely to either produce such violent convulsions nor cause the heart to stop in such a state of engorgement, which was much more in this case than mere diastolic relaxation, and was obviously part of a general venous engorgement due to asphyxia."

Confirmatory evidence was obtained by experiment on sheep, as follows:—

Test No. 3: 11th August, 1905.—About seven grains of the salt in aqueous solution was injected into a sheep weighing about 50-60lbs. The first spasm was manifested five minutes after injection. In six minutes the animal fell to the ground in a rigid condition, and was subject to spasms up to 12 minutes after injection, when death ensued. A *post-mortem* examination revealed similar conditions to those which were found in the guinea pigs.

Test No. 4: 11th August, 1905.—About six grains were similarly administered to another sheep, and an attempt made to control the action of the alkaloid by a subsequent injection of morphia. Owing, however, to delay in the second injection and other causes, this test was not satisfactory. The animal died in 12 minutes, with symptoms similar to those manifested in test No. 3.

Though it is very desirable that full and carefully planned experiments be carried out to more exactly ascertain the symptoms and fatal dose of this alkaloid, the above experiments sufficiently demonstrate its highly poisonous nature and general characteristics.

The final question then arises, how can the information so far gained be turned to practical account in diminishing the heavy losses of stock which annually occur from eating this plant.

For a conclusive answer to this question definite experiments must be carried out, and these I hope will be arranged shortly; but I am of opinion that much valuable information is already available which—

(1.) Indicates the line of experiment most likely to give successful results, and

(2.) Gives reasonable promise of such a successful issue.

This was of course the primary object of the research, and it is of such importance that I desire to go into the matter fully at this stage before the experiments are commenced, so as to explain the reasons upon which the experiments have been planned.

In the treatment of poisoned stock there are two general methods which may be followed—

The first method is by the injection of alkaloids or other substances which will produce a counter effect to the poison originally swallowed and delay its action until it can be removed from the stomach, as well as produce an antidotal effect in the circulatory system, etc.

The second method is by the administration through the mouth of such substances as will act upon the poisonous substances in the stomach, either destroying it altogether or allaying its absorption until it can be removed by mechanical (stomach pump) or physiological means.

In general terms it may be said that the first method must be applied by hypodermic injections, and the second by means of drenches.

The first method (applied in many cases of medical treatment) is perhaps of too technical a character and requires too much special skill and knowledge to be applied with success by stockmen and others who are not possessed of special training, and requires, moreover, appliances not readily available under the circumstances in which they would frequently be needed. For the present, therefore, I think this method may be passed over in favour of one more likely to be practically applicable.

I propose, therefore, that the experiments should first be devoted to trying the method of drenching, and there are two substances which seem to promise well for use in this way.

1. Many of the alkaloids form insoluble compounds with tannic acid, and it is a recognised method of treatment in certain cases of suspected poisoning to administer a tannin solution with the idea of forming such an insoluble tannate in the stomach. The insoluble nature of this compound prevents the alkaloid from being absorbed into the system, and so it is retained in the stomach and can then be removed by special means.

This tendency to form an insoluble tannate is particularly marked in the case of cygnine, so much so that, owing to its relative stability, we used this compound as a means of extracting the cygnine from the York Road plant, a method of extraction, if not new at least very unusual, and adopted for the special reason indicated.

It is quite probable that this property could again be taken special advantage of in applying the method of treatment, and a solution of tannin (bark infusion) is so readily obtained anywhere that one might almost say that it is indicated as the natural remedy. I propose, therefore, to make exhaustive trials of this method.

2. A still more promising substance, however, is permanganate of potash (Condy's fluid).

This substance is a strong oxidising agent, readily attacking organic matter, a fact which is taken advantage of in its application as a disinfectant. Its action on any substance, however, will of course be in proportion to the readiness with which the substance will become oxidised, the oxidation being indicated by the loss of colour in the permanganate solution. Many of the alkaloids are readily oxidised by permanganate of potash in this way and will be destroyed readily, even in the presence of relatively large quantities of other organic matter. The ease with which they are thus destroyed being in a marked degree proportional to the ease with which they are decomposed.

For instance, conine, nicotine, and aconitine are instantly acted upon while others are oxidised in varying periods of time. One medical man, in order to convince the medical fraternity of the practical value of the antidote, swallowed three grains of morphine sulphate followed in about 30 seconds by 4 grains of permanganate. No ill effects were observed although the dose of poison swallowed would have ordinarily proved fatal.

These facts have been taken advantage of in America for the treatment of stock poisoned by eating the indigenous poison plants, with success. In Bulletin No. 26, U.S. Department of Agriculture,* is given a full description of the method of application, and accounts of the results achieved in various cases.

If there is any alkaloid which could be successfully dealt with by this method it should be cygnine. I have repeatedly throughout this report drawn attention to the extreme ease with which it undergoes decomposition, a fact which has affected the whole research which has been conducted, and which was forcibly illustrated by the production of the cubical crystals already described (photo.).

Theoretically, therefore, it is a case peculiarly suitable for the application of the permanganate treatment, and this has been confirmed by the following practical test made in my laboratory:—

Half a pound of the powdered York Road plant was treated with slightly acid water in order to extract the alkaloid, and then to the mixture of extract and a solid material was added 10 grains of permanganate of potash. This was instantly decolourised, showing that it had oxidised some substance present, and when tested immediately after the extract gave no tests for alkaloid, showing that the latter had been destroyed even in the presence of a large quantity of other organic matter.

This method had also the strong recommendation that it is very easy of application.

One objection which I have constantly heard advanced against the practicability of any method of treatment is this: In many cases the stock have been found to be poisoned only when they were in such far-gone condition that any method of treatment would be hopeless. This may be true in some cases, but it must be remembered that no attempts at treatment have (as far as I can gather) ever been made, and therefore their efficacy has never been tested. The resistant harsh character of the plant renders it extremely probable that it is only by gradual degrees that the poison is dissolved out of it by the acid gastric juices, and that it is only by a gradual accumulation that the fatal dose is finally reached.† It is therefore to be expected that symptoms will manifest themselves long before the fatal dose has been absorbed by the animal, and that remedial measures could then be employed with success. I believe it is true that in many cases also a stockman may have strong grounds for fearing that his stock might have been poisoned, and if he has at command a method of treatment he would in such case be able to watch for first symptoms and guard against fatal results in a way not hitherto possible. Possibly the knowledge that they had no preventive available has induced a certain fatalism in stock-owners, who have therefore allowed stock to remain all night (only to find them dead in the morning) even when they may have had good grounds for suspicion that they had been on "poison" country.

Thus I have indicated the lines of inquiry which will now be followed up. Attempts have been made to induce sheep to eat the dry powdered plant on which we have worked, but without success, and in order to make

* The Stock Poisoning Plants of Montana, by V. K. Chesnut and E. V. Wilcox. † The rapidity of death in the life-tests described above cannot of course be taken as a guide on this point. Subcutaneous injection of the pure salt being an entirely different thing to the ingestion of the plant.

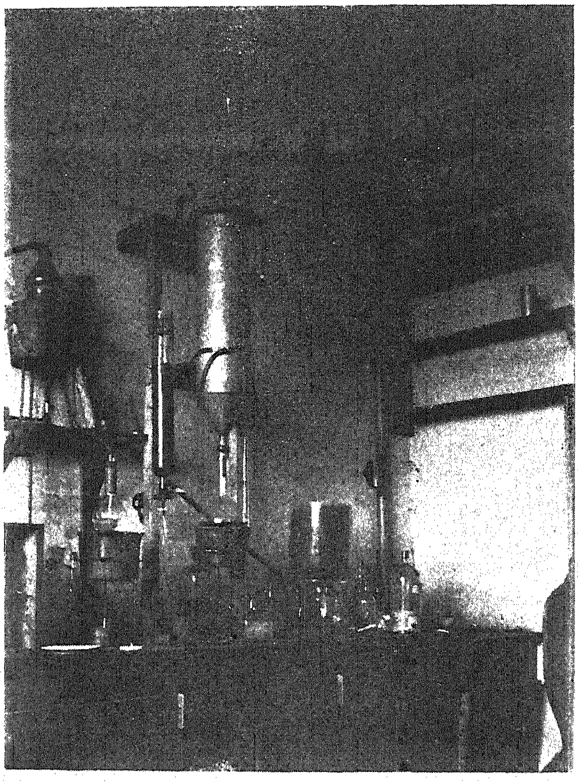


Photo No II.

EXTRACTION' APPARATUS.

the tests under practical conditions we must endeavour to get animals to eat the green and growing plant and then apply the remedial measures described.

The result of these experiments will be embodied in a further progress report at the earliest opportunity.

There is still one other point calling for attention. The alkaloid which has been discovered may possibly prove to be of value for medicinal purposes, but to ascertain this it would require to be examined by an expert pharmacologist. I have written personally to Professor Bottomley of King's College, London, asking him to make inquiries as to how this could best be done and will communicate his reply to you.* It may possibly be found advisable to submit samples to one of the large manufacturing chemists in England like Messrs. Burroughs, Wellcome, & Co., who would investigate it and, if useful, open up a market for its sale.

FOWL TICK EXPERIMENTS.

By Frank H. Robertson.

With the view of obtaining information as to the habits and life history of the fowl-tick, several lots of tick were enclosed in small glass-topped pill-boxes, which were made practically air tight to prevent any possibility of escape from confinement, and as fowl's blood is the ticks' food, no nourishment of any kind could be supplied.

The first experiment made was on 26th May, 1903, to place about 100 adult ticks in a glass bottle, securely corked. A piece of blotting paper was placed in the bottle to make a harbour. It was not until the end of August, 1905, that all ticks were found dead, or two years and three months after being confined.

No. 2 Experiment.

1904.

15th Feb. —8 adult tick placed in a pill-box with glass top.
4th June. —8 more good fresh tick placed with the others in same box.
7th Nov. —All the first lot dead, others bright, full bodied, and good colour.

1905.

3rd March.—8 tick alive and looking well, had laid eggs and hatched large number of larvæ.
3rd April. —Larvæ all alive, and more eggs laid.
5th May. —All adult tick alive, larvæ rather torpid, but lively on exposure to light.
28th Aug. —6 adult tick alive, but very few larvæ.
9th Oct. —A fresh lot of larvæ there.
30th Nov. —Large number of very lively larvæ.

* In a reply since received, Professor Bottomley has informed me that he has kindly arranged for an examination to be made by Dr. Dixon, head of the Pharmacological Laboratory, Cambridge, and I have accordingly sent a parcel to England.

No 3. Experiment.

1904.
17th Feb. —Large number of tick eggs placed in pill-box, all eggs hatched in a few weeks; date not recorded, but other tests show the period of incubation as a month.
7th June.—Several larvæ alive.
27th June.—One alive.
18th July.—One alive.
1st Sept. —All dead.

No. 4. Experiment.

1904.
17th Feb. —Tick eggs placed in pill-box.
3rd April.—A strange insect had germinated in the box, very shy and active, showed it to Mr. Compére, who said it was a scavanger.
17th May. —Tick all dead.
28th Aug. —Nothing alive.

No. 5 Experiment.

1904.
26th April. —About 30 Nymph tick enclosed.
27th May. —All moulted, and entered adult stage, having four pairs legs.
1905.
3rd March.—Several alive but thin, not grown since last observation.
3rd April. —Only three or four alive; another insect appeared.
31st May. —Only one alive.
28th Aug. —All dead.

No. 6 Experiment.

1904.
27th May. —One large tick only, enclosed 27th May, 1904.
7th Nov. —Still good colour and condition, slight brown rim.
5th May. —Alive but thin.
28th Aug. —Just alive, died shortly afterwards.

From the first of these tests it will be seen that tick will remain alive for two years and three months without the presence of any fowls from which to derive sustenance, and as the tick in all these experiments were enclosed in small pill-boxes which were practically air tight, it makes the tests more severe than if they were carried out under natural conditions.

Test No. 2.—Gives a striking illustration of the remarkable reproductive power of ticks, as those confined on 4th June, 1904, had on 9th October, 1905 (or 16 months after), produced young, having in addition produced young seven months previously, viz., in March.

Test No. 3.—Gives proof of the risk poultry-keepers run from conveying boxes or other paraphernalia from a tick-infested yard, owing to the probabilities of such containing infecting germs in the form of tick eggs, which will hatch in about a month's time when conveyed to new quarters. Their great tenacity of life is further strongly exemplified, as this test shows that after leaving the shell they remained alive for nearly two months without any nourishment. Under natural conditions tick at this stage are particularly troublesome, and have caused great losses to unsuspecting poultry-keepers who have removed their fowls to apparently clean yards and fowl-houses, but which have too often proved death traps to strong healthy birds, owing to their being badly infected with starving larval tick.

No. 5 Experiment, shows that nymph tick like those in the larval stage, will live for two months without nourishment; also that tick in any stage of development do not pass on to the next stage when kept in confinement.

The Sixth Experiment was made with the object of ascertaining if a single tick would live in confinement without nourishment. The tick referred to kept alive for fifteen months, thus settling that question. At the same time it has yet to be proved whether ticks do live on each other or not. In test No. 2 it will be noticed fresh ticks enclosed on 4th June throve well, whereas the lot placed in previously were all dead in five months' time.

POULTRY NOTES.

By Frank H. Robertson.

Disposing of Cockerels.

What to do with the cockerels at this time of the year is a question that comes before every poultry breeder, especially when pure-bred stock are kept; they are too good to kill, and it is hard to find buyers for them just at the time you want to get rid of them at anything like a decent price. The best plan is to use all the worst specimens for one's own table, keep the good ones in a pen by themselves, and sell them off gradually at their true worth during the breeding season when the demand arises for good birds for stock purposes; only the very best should be kept, all stunted or weakly birds should not be put into the cockerel pen. Another way of getting over the difficulty is to make capons of many of them. All obnoxious qualities are thus destroyed, and they can be allowed to run with hens in the open, if the fowls are kept in that manner, where they will lead a quiet existence and put on flesh. It is quite a mistake to allow cockerels which have commenced crowing to run with hens and pullets, as they worry their yard mates and do not make good table birds themselves, but if put into a pen out of sight of the hens, they attain size and put on flesh much better, and if judiciously fed and sent to market plump, sell well, whereas the youngsters which have been allowed to run with hens are poor and staggy, and fetch prices accordingly. There are some breeders of pure stock keeping only breeds of the light, good laying varieties, who sell off all cockerels as soon as the sexes are distinguishable; this, no doubt, is advisable where room is a consideration, and the quality of the stock kept is such that it would be impossible to get a sufficiently good price to pay for the time they are kept. The conclusion, therefore, to be arrived at is to

keep stock that excels in some particular respect as the best of its kind obtainable, whether it be as ideal all-round birds, extra good laying strain, or show stock. It then pays to put up cockerel pens, and to keep the birds until the time of the year when buyers are most numerous. Let it be known as widely as possible that good poultry are for sale, by advertising in newspapers, etc. Exhibiting at shows is also a good means of obtaining publicity, especially in the district where the breeder resides. This *Journal* takes advertisements, and special rates will be arranged to suit poultry breeders.

Poultry Statistics.

Although our egg importations have for years past been steadily increasing, it is satisfactory to learn from the Government Statist's returns that the production of poultry has been increasing, and between 1903 and 1904 there has been a large increase. The figures are as follows, 1903 being in parentheses:—

Fowls	451,615	(338,124)
Ducks	73,280	(36,233)
Geese	6,027	(4,102)
Turkeys	32,112	(18,287)
	563,034	(396,746)

Being an increase of 166,288 head for 1904 over the previous year. The total number of poultry kept, however, greatly exceeds the above, because the returns are only those from rural holdings.

HORSE-BREEDING.

By R. E. Weir, M.R.C.V.S.

It is gratifying to find that much is being done this season by farmers to meet the demand that continually exists for draught horses within the State, but a great deal has yet to be accomplished before any degree of perfection can be obtained, or a proper system for the advancement of breeding fully established.

This subject has lately been occupying the attention of our Eastern friends, more particularly with regard to the improvement of the lighter class of animal, but up till now the acme of perfection has not been attained, and the best course to pursue to insure absolutely satisfactory results has yet to be defined.

My attention has been particularly drawn by some of our local breeders to the presence in the State of so many inferior sires, which are in competition with the better class of horse. This is, indeed, a serious obstacle to the improvement of our standard; one which, unfortunately, the importers of valuable stud stock have to contend against. Undoubtedly some steps require to be taken to bring about a better condition of things, and with this end in view the "premium" system appears to me the best method to pursue, for its operation in Great Britain for many years has demonstrated the advantages to be derived from such a course. The improvement of the Clydesdale, which is now looked upon as the most serviceable draught horse in the world has eventuated from this system. The idea is to award a "premium" to a certain sire which competent judges consider the most suitable for the district to be travelled over, and the service fee is usually made as light as possible, so that the farmer with the smallest of means is able to avail himself of the opportunity of improving his stud by the animal's service. It will be seen, therefore, that the best horse for the money subscribed in the district is chosen, and, in due course, a degree of perfection is arrived at, which, in a very short while, will be unmistakably evinced in the offspring. These conditions might easily be applied here with success, and nothing, in my opinion, would tend to do away with the inferior sires so much as the adoption of some such scheme. It would rest with the various agricultural societies to carry out the project; and to assist in this direction, the Royal Society could hold an annual exhibition during the off season for sires alone, and representatives from the various societies could attend and select their horse for the following season, when they could have the assistance of a qualified veterinary surgeon to advise as to soundness, etc. The difficulty, no doubt, with the societies would be the lack of funds, but here the Government could come to their aid, and advance an annual sum to each of the societies for this purpose; and I am sure the small expenditure thus incurred would be more than compensated for by the production of stock which, in the near future, might favourably compare with any part of the world. This system more particularly alludes to the improvement of draughts, but a similar course might with advantage be followed in the breeding of remounts for export purposes. It would be found by the Government that this would result in the most economical and practical method of permanently improving the live stock of the State. It may be advanced against this that there are not sufficient sires in the State of such a high standard as will be required to perform service in the numerous agricultural centres; but, in this event, we are safe in anticipating that the best our Eastern States can supply would soon be forthcoming to make up the complement.

GARDENS OF THE GOLDFIELDS.

HINTS TO ORCHARDISTS.

Mr. A. Despeissis, viticultural and horticultural expert of the State Department of Agriculture, gave an interview during his stay in Kalgoorlie to a representative of this journal, says the *Kalgoorlie Miner*. Mr. Despeissis, who has acted as adjudicator for prizes to be allotted to the best gardens on the goldfields, said:—

"Practically the result of the competitions initiated by the Goldfields Water Supply Administration already shows that the seeds sown have been introduced to fertile ground. Although the board has gained a most important source of revenue as measured by the quantity of water passing through the meters, yet the owners of land who are consumers for gardening purposes secure a more equivalent return for their outlay, apart from the unspeakable feeling of comfort which banks of greenery and abundance of cultivation lends to life in arid climates. It also meant that material and substantial advantages were gained in raising home-grown fruit, vegetables and flowers for the grower's own use as well as for distribution locally. The competitions had unquestionably rendered good service in dispelling the impression that had been entertained that the climate was unfitted for the cultivation of flowers, fruit, and vegetables.

FRUIT TREES.

As to fruit-growing on the goldfields?

"My visit to the gardens entered for the competition has provided ample evidence that for the production of apricots, nectarines, and some kinds of peaches the goldfields are better suited than the coastal districts. That expression of opinion may appear to be a bold one, and it may be that experiences based on several successive seasons may discount it to some extent. With water supplied at a specially low rate for garden areas it seems to me that good sound business could be done by the goldfields in supplying their own communities with a great proportion of the apricots, peaches, and nectarines which are now imported here. The consideration of freight to the goldfields is also a very considerable one, and then, again, the season is earlier by a couple of weeks as compared with the coastal districts in respect of the three kinds of fruit which I have just enumerated. It also seems to me that more reliable crops could be raised of those products in the interior of Western Australia than appears to be possible closer to the coast, where the raising of apricots and some of the best varieties of peaches have hitherto resulted in a good deal of disappointment. Apricots and peaches grow to enormous trees down at the coast, and they blossom, but are not reliable bearers. The same kind of apricots, peaches, and nectarines more especially, which are not productive there, throw their fruit here without any trouble. As a matter of fact, on the goldfields a good many of the

young trees are fruit-bearing, and orchardists here would exercise a wise policy if they thinned out the crop the trees are carrying at the present moment. However, they bear so freely, and they are so very prolific that it is not unnatural to think they will not have a long life, but if they have a period of usefulness extending over eight, nine, or ten years, I believe, even taking into account the expenes of clearing and preparing the soil and stocking with trees, a substantial profit could be shown on the undertaking. Fresh fruit from a garden is very much appreciated, and the grower would receive greater prices for his product than would be given for the fruit which had to stand a long journey.

" During my visit I saw a few young cherry trees, which look most promising, and I shall follow their career with a good deal of interest, as cherry culture has been one of the least profitable speculations undertaken by fruit-growers near the coast. It is possible, in spite of the apparently severe climate, that cherries will find in the goldfields' regions a more congenial atmosphere than pertains with regard to that class of fruit in other parts. The matter is in the nature of an experiment, which I shall watch with interest. Owners of orchards stocked with the trees I have mentioned would find that their grounds could be utilised to a greater degree by the growth of crops between the trees. Such crops, for instance, as garden peas in the winter and tomatoes in the warmer months would prove advantageous to the grower. Consumers on the goldfields were prepared to pay long prices for the class of produce in question, and on account of the earlier seasons and the fresh condition in which the local produce would reach the market, I believe that that description of cultivation could be made to pay.

The Use of Water.

" Mr. Despeissis then went on to state that the proper distribution of water had become a fine art in many parts of the world, and that he had observed to his pleasure and surprise that many of the owners of cottage gardens on the goldfields had acquired a thorough knowledge of the art. He continued: 'I find that some owners with the similar natural conditions pertaining to climate and soil use far less water than others, and they distribute water in a better manner. Instead of giving the garden a daily sprinkling, they give it a weekly or a fortnightly soaking, and further conserve the water from prompt evaporation by giving the ground a mulching of horse manure spread over the surface.

Salt in the Ground.

" Very probably difficulty may occur in the near future with regard to the question of salt in the ground. It was the experience of arid countries such as California, and nearer home—Mildura, on the Victorian side of the Murray River—that the ground as a rule contains a greater amount of chlorides, more especially 'common salt,' than in moister regions. By constant watering, these chlorides are brought up to the surface of the earth by capillary forces, and are there left when the vapours have evaporated. The deposits accumulate to such an extent that they become a source of trouble. Although I have not yet noticed any strong evidence that salts have accumulated on the surface of the soil at Kalgoorlie; yet there are indications of their presence, and it is not unlikely that in the near future trouble will arise in that direction. When that time comes a good proportion of the salts can be prevented

from rising by the adoption of a system of underground drainage. That can be accomplished by sinking a small hole five or six feet in depth, width, and length somewhere upon the ground, and laying down drain pipes for conveying the drainage into that receptacle. In that way the rising of the salts would be checked. Holes of the kind could be utilised as cool storage places for the home.

Shrubs and Plants.

"There are a few shrubs and plants specially suited for cultivation here. Amongst the shrubs and plants of economic value and pleasing effect that are likely to do well on the goldfields is the cotton plant, Pomegranates, that are a feature of the gardens of Andalusia, in Southern Spain, should grow well on the goldfields. The purple plum, with its very striking foliage and a fruit very like the cherry plum, should also be planted. Then there are the cacti, the date palms, and the Sturt pea, the 'seven year bean.' The latter makes a fine creeper, the blossoms are beautiful, and the bean is of the edible variety.

"Oranges and lemons are plants that I would not advise growing here. They are only wasters where there is not a plentiful water supply, and they grow better oranges and lemons down below. The ground they occupy and the water they require could far more advantageously be used for the growth of other trees or ornamental shrubs."

Places of Local Interest.

"Apart from the prosecution of my professional mission, I have also had the good fortune to visit the Kalgoorlie racecourse, the respective bowling greens of Boulder, and the Hannans Club, and the municipal gardens and squares of Kalgoorlie. Although I have not yet arrived at the dignity of a bowler, I venture to say, without fear of contradiction, that the bowling greens I have visited at Kalgoorlie and Boulder are as fine as some of the best at the coast. The committee of the Kalgoorlie Racing Club deserve the thanks, not only of the racing public, but of the whole community for providing and maintaining such magnificent lawns, shade trees, flower beds, and conservatories. The shade-house contains splendid specimens of plant life. The municipal gardens also aid in no small degree the attractions of the town, and provide, as well, very pleasant promenades. It has been my misfortune that pressure of work has not enabled me to give the time for a visit to the Boulder racecourse, which I understand, is also a very striking example of what can be done by a combination of water and brains.

"My stay upon the goldfields has been a very pleasant one to me, and I feel greatly indebted to Mr. T. S. McNulty, the Secretary of the Goldfields Water Supply Administration, and to Mr. McQueen, the district engineer, for arranging the programme of my visit, thus enabling me to see so much in a short space of time."

Mr. Despeisses, who had incidentally contrasted the Kalgoorlie of the present day with the Kalgoorlie of six years ago, in the matter of gardening, then brought the interview to a close. Mr. Despeissis, it appears, had come to this centre six years ago, and had observed that the local gardens of those times were contained in kerosene tins, which were placed on verandahs, that is to say, when cottages possessed those adjuncts.

York Gum Country at Chapman Experimental Farm. Rung Suckers kept down by Sheep.

REFRIGERATION AND COLD STORAGE.

By Mr. A. D. Cairns.

In the recent series of lectures promoted by the Agricultural Department, the manager of the Government refrigerating works (Mr. A. D. Cairns) lectured on the subject of "Refrigeration and Cold Storage."

Mr. Cairns said that it was fitting in the nature of things that cold storage should find a place in the syllabus of the Department of Agriculture lectures, and the director, ever anxious to stir up interest in the success of the man on the land, had a happy inspiration in introducing the cold storage man's share in the chain of operations between the grower and consumer. Next in importance to a sowing of seed was the harvesting. The years of labour spent by the departmental experts in studying West Australian conditions and instructing the growers in what to do or what to avoid would be so much time and money wasted were a means of outlet not considered. Cold storage or mechanical refrigeration had solved that problem, as well as many a knotty one in the commercial and industrial world. It was no idle dream to say that after what it had done for Australia it might some day take precedence of mining, and that the gold and wool currency might yet be equalised by the meat or mutton currency. This was a progressive age, and scientific agriculture, aided by the inventions of the engineer and chemist, promised to make

Gluts and Famines a thing of the Past.

The three most common methods of food preservation were (1) The antiseptic method with salt, etc., to prevent decay; (2) the sterilising at high temperatures, and air-tight sealing, as in tinned goods; and (3) the use of cold air. Regarding the latter, its possibilities were practically unlimited, and with its high value as regards public health no greater service had been rendered to mankind in the whole hygiene of dietetics than by its invention or adoption. Inventors, practically within the lives of persons living, had made the problem of feeding nations, equalising surpluses of fat years of one place and adjusting the lean years of another, by this cleanly expedient. The temperature of the Arctics or the dryness of a Siberian blizzard could now be machine made in the tropical desert. Cargoes of ice in small sailing ships from Norway to Melbourne had given place to a mammoth line of mail steamers, each carrying its own producing machinery, that at one and the same time could carry the flocks of scores of square miles of pastoral area, the dairy products of the same district, its fruit, eggs, poultry, and vegetables, rush them to the other side of the world and deliver them as fresh as when they left their native soil. The magnitude and influence of the cold storage oversea trade and what it meant to both Australia and the parent country was a triumph second only to that of the honour of bringing it about.

We in Australia knew that with James Harrison, of Geelong, rested the honour of making the oversea transport of goods in a frozen state a practical success. After oversea transport had been established in the colder latitudes between Great Britain and America on the perfecting of Harrison's method by the fresh vigorous scientific circle within the easy reach of Glasgow University, they turned their eyes to the Antipodes, and the work began in real earnest in 1881-2. The stock in the two older States at that time was:—New South Wales, $2\frac{1}{2}$ million beef, 35 million mutton; Victoria, $1\frac{1}{4}$ million beef, $10\frac{1}{2}$ million mutton; New Zealand, three-quarter million beef, 13 million mutton. These figures gave some idea of the incentive at this end, while the famine prices of meat in Great Britain added a further stimulus to investors if that were needed. From that day neither Australia nor New Zealand have looked back. The beneficent influence of mechanical refrigeration has fixed their goal, shaped their destiny, and brought prosperity to their gates—the plague of rabbits in Victoria, for instance, thanks to its usefulness, brought £1,000 per day to her trade, and the 13,000 tons of butter export was made a blessing to the farmer. New Zealand last year, among other things, sent over 17,000 tons of butter and over four million sheep and lambs to Great Britain and South Africa. Kindred industries, such as timber, had also a great outlet. Cold storage has created and developed so many centres of activity, such as cheese and butter factories, fodder and chaff-cutting, irrigation, railway construction, that its value to the coal miner was now of vast importance. It would be a difficult matter to enumerate the industries that sprang into life after its advent, or estimate their aggregate wealth to the State.

While it was no exaggeration to state that New Zealand had been made the refrigerating machine, it must not be lost sight of that a vast amount of pioneer work had prepared the country for refrigeration. In 1880, she had 13 million mutton, half-million beef, quarter-million pork, and, contrary to the experience of Australia, she had a very substantial increase on these figures after 15 busy years with the best-equipped works for the purpose. Yet the demand is not met for her products, so great was her hold on the British consumer.

In one form or another cold storage has been known and appreciated more or less ever since people observed that their provisions kept better in the cold than they did in the warm weather. What was termed natural ice, or ice made in the winter time, or in a colder altitude, was practically the only source from which our forefathers drew their supply. Useful as this means was in a small way, it was far too expensive and uncertain to be of world-wide utility. Then came the advent of artificial or machine ice and cold air and its enormous developments.

Cold storage in its fullest sense called forth the best work of the manufacturing chemist, the best work of the architect, and the best work of the machine builder and power economist.

A list of the uses that cold storage was put to nowadays would be a very lengthy one. Besides the keeping of the provisions of everyday use, which formed the bulk of cold storage work, it entered into countless processes of manufacture. The ova of fish are transported in safety, and with the smallest percentage of loss at the hatcheries, through its agency. Rare specimens of every description for the entomologist were transported. The

work of observation of retarded or hastened plant life or the suspended animation of animals can be accurately carried out at different temperatures. What these conveniences meant to the brewer, the dairyman, the cheese-maker, and fruit-merchant could only be appreciated when a comparison was made in price, excellence, and uniformity of such goods now with what they were formerly. As an aid to the civil engineer in tunnelling through quick-sand or mud, it would be hard indeed for science to devise a simpler or more effective method.

Treacherous strata in mines and other forms of excavating work could now be safely taken in hand that 20 years ago were undreamt of, and the manufacture and storage of high explosives ashore and afloat with little risk was now accomplished by its aid.

It was desired to bring before the producers of the State the general application of refrigeration to the needs of the day. Western Australia was rapidly approaching the self-supporting stage in the production of fresh beef, mutton, pork, and fruit as staple articles of food. While some of these necessities could wait a reasonable time before requirement, either in the granary in the shape of wheat, or in the field as live stock, the question of loss or waste, economic or otherwise, assisted itself as soon as storage was to be considered. The more perishable and delicate things of everyday life, such as fruit, berries, eggs, or fish, were a much more difficult problem to tackle, if a steady, continuous, reasonably-priced supply was to be the object aimed at. While the fruit and egg output of the farm or orchard might be turned to profit by storage at a proper temperature by the application of cold storage principles, the greater number of risks from rough handling to fruit or eggs were mostly preventable by care on the part of the grower, packer, and carrier before the cold storage man had them under his care. The work of an agricultural expert in demonstrating how a crop was most profitably produced also embraced the proper harvesting and packing of such a crop.

No system of storage or transport, cold or other, could undo the mischief of unskilful packing or rough handling from the tree or nest. The cold storage man could by the control of temperature and humidity, prolong the mystery of ripening, but he could not restore the bloom, the flavour, or the symmetry once they were tampered with. Quick and safe transport to the cold stores, then, was the first consideration to insure long life and high price for the goods, and an enviable reputation for the grower, his district, and his State.

In the fresh meat business, the bloom and all other appetising characteristics of such meat could only be maintained by the close proximity of the chill-room to the slaughtering pen. In our climate exposure to the air for a lengthened period, while liberating a useful amount of the animal heat, and thereby easing the work of the refrigerator, is so much loss in the appearance of the meat afterwards. Exposure to the breeze of a summer day causes a brown sun-burnt like shade to come over the surface, and if kept hanging after the operation of washing and inspection for even an hour, an aged look would be given to the quarter of a prime young beast. While we looked ahead and conjured up when and where our profitable export of cold storage commodoties would begin, and how we would use the experience of our older neighbours to our own profit, the question presented itself,

What are we doing by way of preparation? The toil of the stock pioneer was now bearing fruit, the annual increase of his flocks and herds were now a very respectable quantity. The work of the farmer and orchardist, too, would soon demand some enlarged method of outlet. To organise and systematise a means of collection, storage, and disposal required time, and while we might not have the vast quantity of either stock or farm produce to begin with that Victoria and New South Wales had when cold storage came to their rescue, we might benefit by their practice in avoiding great waste.

It was now abundantly evident to students of our products and climate that a yearly harvest of live stock was as important as that of crops. Veterinarians said that disease among stock was on the increase. Queensland statistics showed that they had in 1895 6,000,000 cattle and 20,000,000 sheep. In 1902, owing to the ravages of drought and tick, the numbers had dropped to 2,500,000 cattle and 8,000,000 sheep. The quantity frozen for export or used locally appeared negligible on the face of such an appalling loss. Had ten times the quantity that was treated during the above period been turned into cash, the probabilities were that as many would have been available for operation now as ever, and had the former quantities been ten times larger, there was no evidence to show that tick and drought would not have reduced them to their present number. While thinking of export let them look at their own daily supply, and knowing that they could not get very rich if everything was kept at home; they also felt that their first care should be to draw that supply from local sources.

Taking the average consumption per head of Queensland as a fair index of what they might reasonably be supposed to consume in fresh meat per head, if they took the population at 253,000, it would require 67,350 bullocks of a dressed weight of 650lb., 147,000 sheep of 50lb., 3,250 calves of 60lb., 1,400 lambs of 30lb., and 11,600 pigs of 100lb. These figures neither embraced tinned provisions nor bacon, of which various quantities were consumed in different districts. We had a surplus of 163,000 lambs under one year. This showed that a few could be exported as an advertising experiment. A quantity of, say, 10,000 carefully selected, and shipped in 1,000 lots in the London winter, say from now to February, would test the question. They could be killed in some temporary shed near the city, passed immediately into the chill-room, and shipped at Fremantle. The absence of a good cool storage depôt on the wharf as at Sydney, Melbourne, or Adelaide, was a serious handicap to good work. The question of ownership of such works was a matter of diverse opinion, but until the reputation of the State products was established the grading and passing of suitable samples must be under strict Government supervision.

The products of the great pastoral areas, the cultivation of the farmer, and the delicately flavoured fruits of the orchard, could with care be made a source of profit to the growers, and build up trade. Large quantities of perishable produce were wasted last season through preventable causes that would prove profitable to the growers if they were available at the proper time. Refrigeration reduced waste, and its possibilities here were practically limitless, once the system was properly organised. The farmer should be encouraged to grow his stuff without fear, and to stick to his part of the business. If he availed himself of the instructions carefully compiled by the Department of Agriculture products could be known as distinctly Western

Australian, and would gradually rise in favour and importance as the system became more perfect through studying the markets at all seasons. Praiseworthy as all co-operative efforts were, the cold storing and transport of the stuff could be better done by men with capital and well-equipped depôts to feed the shipping centre on the seaboard. It was sheer nonsense to think of a small depôt handling with success mutton, pork, apples, grapes, etc., and shipping them in small parcels profitably. While the man on the land should have an intelligent grasp of the profit and loss side of the question, he could not be expected to have surplus time at his disposal to learn how to run a cold storage business without seriously impairing his usefulness as a producer. Let them profit by the success of New Zealand and their nearer neighbours, collect the stuff along the railway lines, and as long as it was free from bruises and ordinary disfigurement, all grading classification could be made at the shipping centre, where a well-equipped plant with facilities for dealing specially with each commodity under scientifically trained supervision could insure the best results at the lowest prime cost. There was not a very widespread acquaintance with refrigeration or refrigerating machinery in Western Australia, and there was therefore the more need of her benefiting by the experiments of her older neighbours, where technical knowledge on the subject was more in evidence. Cold storage depôts had done much to establish a correct standard for breeders of stock, growers of fruit, makers of bacon, cheese, and butter, as the art of grading and price-fixing could be so well studied where large quantities of perishable foodstuffs were daily passing through.

NOTES ON THE CHAPMAN EXPERIMENTAL FARM.

NOVEMBER, 1905.

By R. C. Baird.

The past month has been most favourable for all cereal crops. The weather has been remarkably cool, thus allowing the grain to fill well during the ripening process. Stripping is now pretty general throughout the district; the yields will, I think, be quite equal to those of last season.

On the farm, hay-cutting was completed in the early part of the month. About 70 tons of hay were cut, partly wheaten and partly oaten, which is now all in the stack. The grain crops are now being cut with the binder, and in the course of a few days this work will be finished. The yields promise to be equal to last year's, although a larger proportion of the land under cultivation this year is of poorer quality.

The "manure test" plots are not yet harvested, but as soon as possible detailed returns will be forwarded.

The grass plots, some of which made good growth during the spring months, are now showing the effects of the hot weather.

The potato crop which at one period gave promise of a good return was attacked by the "potato moth." This pest, after destroying the potatoes, attacked the vines and is doing considerable damage.

The pea crop is now being harvested. A few of the varieties will, I think, give fair results.

The summer crops have not done so well this year, owing perhaps to the absence of rain during the month. Those varieties standing best are, "amber cane," "broom corn," and "Egyptian millet.

A patch of four acres planted with melons, pumpkins, vegetable marrows, etc., is looking very well, and promises to yield a fair return.

The stock are all in good condition. The Angoras are giving some trouble to keep them within bounds.

EXPERIMENTAL FARM, NARROGIN.

REPORT FOR NOVEMBER, 1905.

By Frank L. Faulkner.

This month has witnessed the advent of summer in earnest. Grass has dried off very quickly, and all the crops have ripened with great rapidity.

Hay-cutting is well under way, and cutting for grain will start in a week or so.

The hay crop will be light—not more than 15cwts. per acre—as it is all very short, and I have had the low-lying country—where the crop is light and very grassy—cut out with the grass cutter for manger hay.

The grain crop will be better than I hoped for; all the wheat filling and heading very well.

Fodder Crops and Grasses.

Peas.—Three varieties of field peas, *i.e.*, "The Blue Grey," "Dunn," and "Partridge," and each variety has been tried with and without the "nitrogen fixing bacteria" obtained from the United States Department of Agriculture. In every instance no result at all is observable from the treatment with the bacteria, the untreated being equally as good as the treated plot. Of the varieties, the "Dunn" has given the best results, giving abundant growth and setting well.

The Grey Pea grew rather poorly, but podded fairly well. The Partridge has grown very luxuriantly, but is a later variety; and so far has not set so well as the other varieties.

Vetches.—About quarter acre each of black and golden vetch were drilled in, but beyond giving a little green feed the crop has been a failure.

Chic Pea.—A small plot of this sturdy little ligume was drilled in in June. It grew to 10 inches or one foot high, but did not give a very heavy crop of either grain or green fodder.

Lucerne.—One acre drilled in in July on a piece of well-prepared fallow land germinated well, but grew very slowly, and allowed the native grasses to outgrow it. Three acres sown early in September also germinated well, but did not seem to make much headway. Latterly these two plots have suffered very much from cut-worms.

Eight acres of wheat were sown with lucerne seed, the seed being broadcast after the crop was two to three inches high. It was then harrowed and rolled. The lucerne has only appeared in patches. The country that these lucerne plots were sown on was fairly good-looking, but rather loose red-gum sand, and although it has done poorly this season, I think it will do much better next year, when it will have established its root system better.

Tree Lucerne (Medicago aborea).—A very distinct plant from the so-called tree lucerne, or tagosaste. A small plot of this sown last season has not made very much headway. Of a plot sown this season only a few plants germinated.

Red Clover.—One-eighth of an acre, sown early in September, started very well and germinated well, but the season has closed too soon for it. I think red clover will do fairly well as part of a mixture if sown earlier in this district.

White Dutch Clover.—A small patch, sown early in the winter, did very well on cold low-lying country.

Grasses.

Paspalum dilatatum.—Small plots of this grass have been sown at intervals, both alone and in mixtures of other grasses, through the winter and spring. The first plot was sown in May, and the last on September 20. With the exception of the last plot, all have failed to germinate, or, if they did germinate, the plants were killed by the cold.

The plot sown on September 20 germinated fairly well, and where the land is still moist, it is doing very well. On the higher ground, however, where the moisture has got too deep, the plants are very backward, and it is doubtful if they will survive the summer.

In addition to the seed two acres were set out with paspalum roots; one plant to every two feet square. During early July this grass took well,

almost every set living; but it grew very little till October. It is now doing very well, and making nice tufts of sturdy healthy growth.

Paspalum virgatum.—This paspalum is harder than the *Paspalum dilatatum*, though not quite such a good fodder. Stock, however, eat it readily during the summer, when everything else is parched and dry.

Paspalum distichium, or water paspalum.—A few small roots of this were obtained through Messrs. Rossiter and Co., and planted in a very wet swampy spot. The roots are spreading rapidly. This promises to be a very useful grass for these wet swampy patches, as it stands innundation with water, and stock eat it readily.

Ergrost's Silosa.—A sack of these roots were planted out similar to the *Paspalum dilatatum*. It is a narrow-leaved free seeding grass, and is doing remarkably well. It is now 18 inches high, seeding freely, and still green and luscious. Should be an exceedingly good grass for this district.

Rhodes Grass (Chloris virgatis).—A few hundred roots of this grass were also set out similar to the paspalum. A large number of the sets died out, but the survivors are growing fairly well.

African Wonder Grass (Pauicum spectabl).—A similar quantity to Rhodes grass was planted, and a fair percentage died also. The remainder are growing and stooling out freely.

Cocksfoot (Dactylus glomerata).—About one acre sown last season on very poor rubble and white pipe-clay land survived the summer, and came on early and well with the first rains this season.

Several lots of Cocksfoot have been sown during the year from July to 20th September, and although they all germinated freely and came on very well, the season closed too soon for them. This grass, and in fact all the winter grasses, will require to be sown either just before or else just with the early March or April rains.

In addition to Cocksfoot we have varying-sized plots of the following—but the result in every case has been similar, *i.e.*, the grass was dried off before it developed into seed:—Perennial Rye grass, Poverty Bay Rye grass, Rib grass, Tall Timothy, Kentucky Blue grass, Smooth-stalked Meadow grass, Sheep's Burnett, Festuca Elaton, Hungarian Forage grass, and Dauthonia Semiannularis. Of these Cocksfoot, Rye grass, Rib grass, Sheep's Burnett and Dauthoma Semiannularis, will, I think, prove the most useful for pasture in this district.

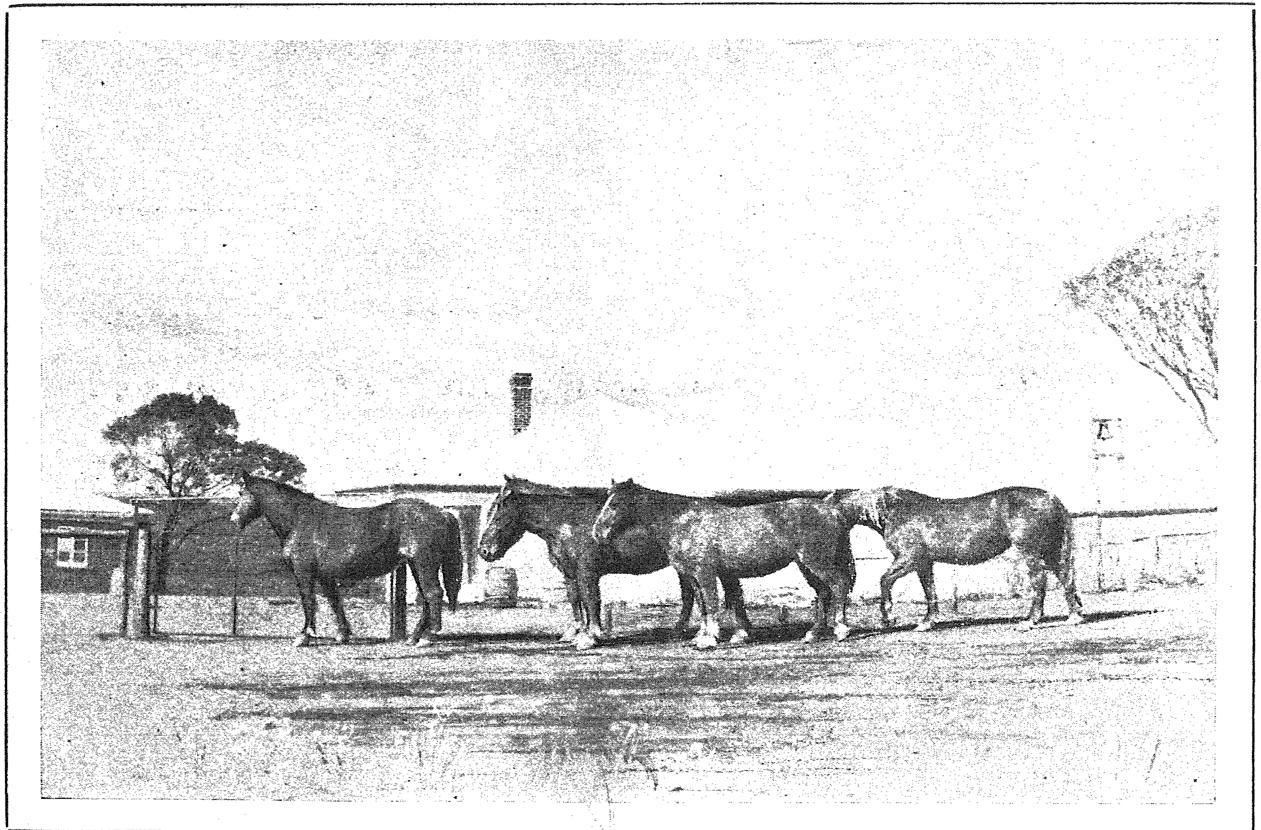
Saltbushes.—The following saltbushes were sown. Small plots of each, but only an occasional plant of each has germinated:—

Atriplex Mumurilaria ...	... None germinated.
Do. Semibaccatal ...	... One or two plants germinated.
Do. Holocarpa ...	... Two or three plants germinated.
Do. Halimoides ...	... Several germinated.

None of these have made satisfactory growth.

The Shearing.

Shearing was completed early in the month, and the results have been fairly satisfactory. The wool was very clean, fairly well grown, and even the breeding ewes fairly sound in the staple.



Imported Suffolk Mares at Chapman.

The Shropshire stud ewes averaged 7lbs. wool; 97 Shrop and Merino Hogget ewes averaged 6½lbs. wool of fairly nice even quality, well grown, and good yielding. Flock ewes carrying lambs averaged 5¾ to 6lbs.

The Shrop and Merino lambs cut 3lbs. each of nice light well-grown wool.

Our flock of nondescript merino ewes is gradually being reduced, and a more even better line of Shrop and Merino ewes of our own breeding taking their place. We have now over half of our flock of 400 odd of this class.

During the past year we have lost in all not more than half-dozen sheep from poison, which shows what can be done even on the worst poison land of the State. Our country was originally all badly poison-infested.

The *Angora Goats* gave only 3⅙lbs. each of mohair, which was rather matted together at the time of shearing owing to its having been left on too long. The shearing had to be delayed on account of the inclement weather almost to the end of October.

I am convinced that much more hair (and hair with a freer and less matted and tangled staple) would be obtained by shearing twice a year—say in March to April, and again in September or October.

The pigs have been on the increase latterly, and we have now some 45 weaners, suckers, and slips. These youngsters are now feeding off a small paddock of peas, and will be ready for the stubble as soon as the harvest is got in.

We have also a few very good young Berkshires for sale, suitable for breeding purposes.

CONDIMENTS IN ANIMAL FOODS.

Some experiments as to the influence of condiments on food consumption, digestibility, and milk secretion, carried out at the Hohenheim Agricultural Experiment Station, by Herr Gustav Fingerling, in 1902-4, have recently been published in the *Landwirtschaftliche Versuchs-Stationen* (Vol. LXII., Parts I.-III.).

The experiments, which were very carefully conducted, were divided into two parts: (1.) The influence of condiments on food consumption, digestibility, and milk secretion in combination with a food poor in condimental substances; and (2.) their value when combined with an ordinary appetising food. The feeding stuff employed in (1.) was artificially compounded of certain materials so as to make up the required proportions of albuminoids, fat, and carbo-hydrates, but to avoid appetising or seasoning materials. It was composed of a bye-product of straw used for manufacturing purposes, earth-nut oil, starch flour, and a bye-product of the manufacture of a protein preparation (Tropon), together with spelt-straw. Certain substances

were added to supply mineral matter in the food. In the second part of the experiment a ration in common use was selected, viz,, meadow hay, brewers' grains, and sesame cake.

The prepared mixtures of condiments which are sold in Germany under many high-sounding names are mostly composed of combinations of the seeds of fennel, fenugreek, aniseed, caraway, and of preparations of juniper, carob, ginger, gentian, liquorice, marsh mallow, charcoal, and various salts. The seeds of fennel, fenugreek, and aniseed were chiefly employed in these experiments, and also one or two patent compounds. The results are valuable as showing by exact experimental methods the small advantage to be obtained from preparations of this character. It may be noted, however, that the influence of condiments on the nervous system and good condition of the animals, not being a factor capable of measurement, did not receive exhaustive consideration. The conclusions arrived at are as follows:—

The condiments tested operated favourably (1) on the food consumption, so that more food was consumed; and (2) by influencing the activity of the milk glands, so that the yield of milk was increased and its quality improved. This favourable result occurred, however, only with foods which were extremely poor in appetising materials, such as the experimental food (1) mentioned above. In a normally appetising food an addition of condiments had no effect. The natural food of animals, it is observed, contains an amply sufficient quantity of seasoning matter, and the further artificial addition of condimental substances is mostly ineffectual, and may under some circumstances be directly injurious, as the long continued use of strong spices may eventually lead to a chronic stimulation and a catarrhal affection of the mucous membrane of the stomach.

The condiments investigated did not show any power of increasing the digestibility of food. It is just this property which has hitherto been chiefly attributed to them, and it has been assumed that by their appetising effect they were able to bring about an increased secretion by the digestive glands, which resulted in better use being made of the food. This view was not supported by the experiments, as with neither of the foods used was improved digestibility apparent.

So far, therefore, as the practical use of these substances is concerned, it appears that the addition of condiments is but seldom advisable, as, for example, when an unpalatable food, such as bad hay, is used. Most of the food materials used on the farm contain condimental substances in sufficient quantities, but in the occasional instances where the food is unpalatable, a trial is recommended with the seed of fennel, aniseed, fenugreek, caraway, etc. The writer concludes by urging farmers not to purchase condimental powders, which are composed in reality of nothing but a mixture of these seeds, with the addition of some other material, such as salt, charcoal, etc., and which are sold at a very much higher price than is warranted by the value of the materials.

NON-FERTILITY AND LACTATION IN MULES.

The subjoined extract from "Horses, Asses, Zebras, and Mules" (Tegetmeier and Sutherland), with which Mr. K. Matheson, of Leigh's Creek station, has courteously supplied us, should prove of interest to our readers, says *Elder's Weekly Review* :—

"The natural history of hybrids of all kinds has not received due consideration even from naturalists and scientific observers, and but little is known regarding them compared with what has been ascertained respecting their progenitors. No careful consideration of the facts relating to hybrids has been put upon record ; a few scattered observations as to the fertility of some, and the sterility of others, are about all that has been made known.

"The extraordinary circumstance that Mr. Bartlett (Superintendent of the Gardens of the Zoological Society) should have definitely ascertained that fertile hybrids can be bred between species as distinct as the bison of North America, the buffalo of India, and the wild ox of Europe, has passed almost unnoticed, though portraits of the singular triple crosses so produced have been published in the proceedings of the Society. But no further experiments have been made with the view of introducing either of these crosses into our breeds of domestic cattle, with the possibility of improving the character of the latter, and at present the only advantage that has been gained by Mr. Bartlett's interesting experiments has been to ascertain the fact that three very distinct species of the Bovidoe, inhabiting different parts of the world, can be bred together in almost any manner so as to produce fertile compound hybrids.

"Regarding the facts that more immediately concern us, the character of the hybrids between the horse and the ass, much more has been ascertained, although little scientific observation has been brought to bear upon the question. The relative influence of the male and female parent in these cases is now well-known, and the distinction between the mule (the offspring of the ass and the mare) and the hinny (the result of the union of the horse and the she ass) is well ascertained. Both offspring depend for their size on that of the female parent. As far as is known from accurate observation male and female mules and hinnies are absolutely sterile, although certain accounts of fertile female mules have occasionally appeared in print.

"Captain Hays, a very practical authority, writing on the subject states :—'Neither the mule (the produce of the jack ass and mare) nor the hinny (the cross between the horse and the she ass) is fertile, either among themselves, or with other members of the horse family. These animals, which have been mistaken by superficial observers as fertile mules, have been, I venture to say, in most cases, the offspring of mares that have previously bred to donkeys, and have endowed their young with some of the characteristics of their former asinine lovers. Both the mule and the jennet respectively 'take after' their dam in size, and their sire in appearance and disposition.'

"Those persons who have paid the greatest amount of attention to mule production and mule industry know of no instance of a female mule

producing young, and M. Ayrault, in his valuable treatise, 'De l'Industrie Mulassiere,' the standard work on mule-breeding in France, says that in Poitou, where 50,000 mares are annually employed in breeding mares, such a thing as a fertile mule is unknown, although these young mules are placed in the most favourable condition for being mated, and they are constantly in the pastures and on the marshes with the young horse colts.

"To this it may be replied that there is a well-known instance in the Acclimatisation Gardens in Paris where a mule has produced foals when mated both with the horse and the ass. As this is supposed to be the most authentic case on record, it has been thought desirable to reproduce from a photograph an exact representation of this supposed fertile female mule, which has been most carefully drawn by Mr. Frohawk. It is doubtful whether the animal is a mule. There is but little character about her, beyond the slight increase in the size of the ears. The particulars of her parentage are utterly unknown, and she was merely alleged to be a mule by the Algerian natives who sold her to the authorities in the gardens. It is not at all improbable that her female parent had bred a mule in the first instance, and, as in the well-known cases of mares which have been mated with quaggas and zebras, her subsequent progeny, when mated with a horse, shows some trace of the first union. The late M. Ayrault, and most persons who are really cognisant of the matter, regard this animal, not as a mule, but as an ordinary mare. She has foaled both to the ass and to the horse. Her foals bred from the ass appear to be ordinary mules, and are sterile, whereas if she were a mule they should be three-fourths asinine and only one-fourth equine, which is not the case. Her progeny by the horse are horses which have proved fertile.

"It would appear most probable that this is not a case of fertile mule breeding, but that the animal is really an ordinary mare, whose female parent was influenced by a first alliance, as is often the case in dogs and other animals.

"There is no doubt that the majority of the accounts of supposed fertile mules owe their origin to the fact that abnormal lactation not infrequently occurs in them, when milk is secreted in great abundance, and they may be seen suckling the foals of other animals. This singular phenomenon is not confined to mules, but is well known to occur in many other species. The maternal instinct is one of the most powerful, and there are numerous examples of its being so strongly excited in females (other than the mother) in favour of the young of animals of the same and even of different species, as to determine the abundant secretion of milk. Domestic animals, such as cats and dogs, have been known to suckle young of other species, even when they had no progeny of their own, and corresponding instances among women who have fostered orphan children are on record in the physiological journals. Nay, more than this, a case is related by Humboldt of a man who became the wetnurse to an infant child. 'In the village of Arenas there lived a labourer, Francisco Lozano, who had suckled a child. Its mother happening to be sick, he took it, and, in order to quiet it, pressed it to his breast, when the stimulus imparted by the sucking of the child caused a flow of milk. The man was examined by M. Bonplaud, who found the breasts wrinkled like those of women who have nursed. He was not an Indian, but a white, descended from European parents.' Other authors have given examples of the same nature."

SHEEP-BREEDING IN CANTERBURY, NEW ZEALAND.

By Wilmot C. Quinnell, M.R.C.V.S., London.

In treating on this matter, one has to look back, say 50 years, and see Canterbury, not as she is to-day, but as she was before the advent of the plough, and before cultivation became the general thing. The Canterbury Plains were then one vast stretch of heaving tussock, with here and there a green patch of cultivation, showing where some enterprising colonist had squatted down, with no other end in view than the breeding of a few Merino sheep, his chief return being the wool grown by them.

These stations or sheep runs, to be profitable, had to have a river frontage, so that the stock might have water. As large tracts had to be taken up to secure this, the plains were in the hands of only a few owners.

What a contrast to the present day, when we find the plains thickly studded with thriving homesteads, and vast flocks of half and crossbred sheep taking the place of the few Merinos! This change was brought about largely through the institution of a system of water-races. By damming the Ashburton and other rivers at the foot of the hills and conveying the water in various main channels from the dam, and again tapping these channels here and there, as a result wide tracts of the plains were supplied with water and turned into a productive farming country. Having increased the produce of grass by converting poor heaths into luxuriant meadows, the settler was now able to keep teams of horses and to cultivate the land, thus preparing the way for the rearing of large flocks of sheep, as he was now able to grow plenty of feed for them, especially to meet the winter requirements. Another great factor in bringing about this change was the advent of the frozen mutton trade about 25 years ago, to which trade Canterbury chiefly owes her rapid advance and the position she now holds.

Although the Merino is a good wool-producing sheep, its flesh being rather dark in colour, were considered for this reason unsuitable for exporting purposes. Hence it became necessary to find a breed of sheep that would produce both wool and good mutton.

In the early days the only breeds available were the English Leicester, Lincoln, and Merino. In crossing the Lincoln and Merino it was found that the mutton was not so good for exporting as in crossing Merino and English Leicester. But the former cross was the better on which to build a flock, because the Lincoln, being recognised as the king of long-wool breeds, and the Merino as having the finest wool of all breeds, the result was a breed having a strong constitution, flesh perhaps a little coarse, but the fleece was beautiful, often weighing (off wether hoggets) as much as 12lbs. The ewes of this cross were very much sought after by breeders of good sheep, for the purpose of crossing with either the Shropshire or Southdown breeds for early maturing lambs, for which Canterbury now bears such a reputation.

The wether mutton of this cross is remarkable for its weight, 18 months old wethers weighing from 60 to 65lbs. The carcase when hung up, is of a long shape, with not too fine a shoulder, showing too much of the Merino nature.

Some years ago a trial was made to establish a new breed of this cross (viz., the "Corriedales," named after the place where the experiment was tried), which has met with a certain amount of success. By taking four distinct crosses to establish the breed, that is by crossing the half-bred with the half-bred it was thought that a sheep capable of producing both wool and mutton would be produced.

The experiment has produced a good wool sheep, but the shape of the carcase and the quality of the mutton is no better than that of the original half-bred. This class of sheep is now being bred more for the purpose of taking the place of the Merino, which in the hill country, at the back of the plains, is fast disappearing.

The wool-bearing nature of the Lincoln Merino cross is very strongly brought out in the old ewes, when five or six years old will be found carrying beautiful heavy fleeces, though perhaps not quite so lustrous as when they were younger, still very dense, and the body beautifully covered. For various reasons this breed is not a favourite with the Canterbury farmer.

(1.) The lambs are slow of maturing, and take a lot of feed to get them fit for the freezing works.

(2.) The mortality amongst the lambs at the lambing season is heavy.

(3.) The ewes require a great amount of attention, which in spring-time the farmer finds he has not time to give.

The favourite cross with most farmers at present is that of the English Leicester with Merino. The lambs are more quickly fattened than those of the Lincoln-*cum*-Merino, and give good weights for their age, at four months averaging 38lbs.

The average price for a lamb of this weight at the beginning of the season is about 14s., but the price rises according to the demand and to the age and condition of the lamb. Just now (August) the price is up to 18s. 9d. Though not so lengthy as that of the previous cross, the carcase is more shapely, the front and hind quarters better covered, showing an inclination to favour the Leicester in shape as in quality. The wethers of this cross are very useful, not being quite so heavy as those of the previous cross. A large percentage of them come within the 56 to 64lbs. grade, which according to grade prices is most profitable.

This cross also gives a better fleece than the Down crosses. The second cross, or three-quarter bred English Leicester, got by crossing the half-bred ewe with the pure English sire, is also very profitable. The carcases of lambs and mutton are inclined to show too much fat for the lean, but are shapely. The constitution of this cross is hardly as good as that of the first cross, but the cross is useful and very much sought after.

For the production and early maturity of fat lambs, the crossing of either of the Southdown or Shropshire with either of the longwool crosses has proved to be successful. The Down breeds are as distinct in themselves as the longwools.

The Southdown has a beautiful shapely body, squarely set on its legs, front quarters about as heavy as hind, short meaty neck, beautifully rounded quarters, neither too much shank nor too much flank, but meat

from ear to hock; in fact, a moving square of mutton. When this Down is crossed with the coarse three-quarter Lincoln ewe, it will give a profitable lamb to fatten, weighing exceptionally well for its age (at four months 36 to 40lbs). The culls, if left to grow into sheep, turn out very good weights (at 18 months will scale 56 to 60lbs. of good well mixed mutton, and will shear a very good fleece). This cross is much competed for by exporters, and often commands a higher price than any other cross.

The Shropshire Down cross is another popular one with the farmers. It is adapted for crossing with any of the half or three-quarter breeds already named in the longwools.

The lambs mature early, and give a good return at four months. The sheep at 18 months are good weights, and very profitable, being good dry country sheep, which come through a dry season very well.

The Cape war considerably aided the Canterbury farmer. Before its outbreak, old ewe mutton was considered as "cast-off," and was used only for local consumption. But after the outbreak this class of mutton became an exportable article, and consequently was of greater value. Now the local butcher has to compete with the export buyer, and as much as 4d. per lb. over all has been obtained for this class of mutton. The system of buying export stuff has changed during the last few years. Ten years ago the prevailing system was for an exporter to purchase from a breeder his season's supply of lambs, at so much per head, taking them away as they were fattened, he in his turn turning them over to some Smithfield meat salesman. But now we have the Smithfield buyer out here, buying on his own system, viz., so much per lb. over all, so much for the carcase with skin and fat thrown in. This system is becoming very popular, judging by the amount of business it commands. It is guided by the London market, and advances or recedes accordingly.

Grades.

The system of weight-grading carried on at the various freezing works is fairly uniform:—

In lambs	L grade	represents a carcase	not over 30lbs.	
"	A "	"	31 to 36lbs.	
"	B "	"	37 to 42lbs.	
		Teg over 42lbs.		
In mutton	L grade	under	48lbs.	
"	A "	"	49 to 56lbs.	
"	B "	"	57 to 64lbs.	
"	C "	"	65 to 72lbs.	
"	H "	"	over 72lbs.	

The value of lamb and mutton is represented in its different grades.

In lamb there are generally just two prices. Same price up to 42lbs., then sometimes as much as ½d. per lb. less over that weight.

In mutton generally a difference of ¼d. per lb. in C and H grades. Say 4¾d. up to 64lbs., 4½d. next, 4¼d. next, so that the heavier the carcase the less value it is per head.

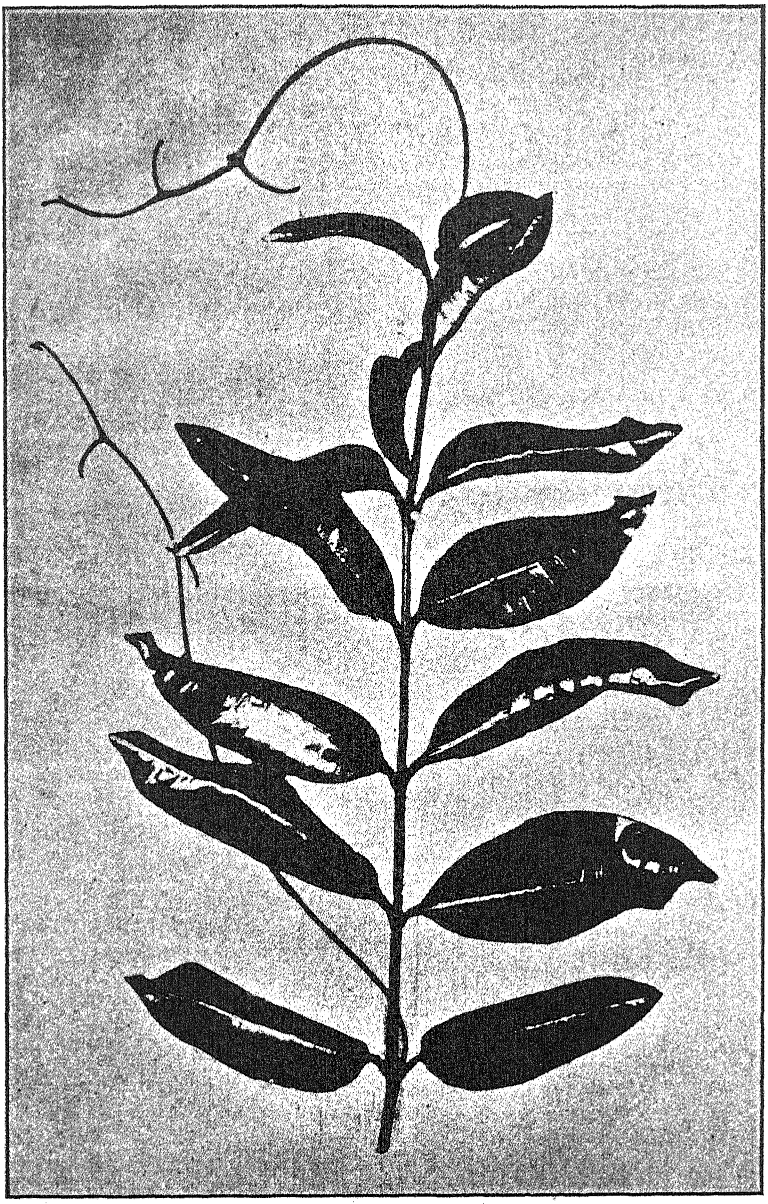
PREVENTIVE TREATMENT OF ABORTION.

From the Midland Agricultural and Dairy Institute, Kingston, we receive official report of experiments on Preventive Treatment of Abortion in Dairy Stock. The veterinary department of the institute commenced these experiments some nine years ago. The first set of trials was chiefly confined to the use of carbolic acid. The second set was commenced in 1902 for the purpose of testing the effects of various other germicides, and at the same time to obtain, if possible, further knowledge on the contagion of the disease:—In an interim report published last year I gave a summary of the information collected up to April, 1904, on the effect of the preventives tried, and from a further experience gained during the last 12 months, from trials carried out at two centres, I make this additional report. For the benefit of those who may not have seen last year's report I am including a short *résumé* of what was stated therein.

CENTRE I.—Cows had aborted on the farm for the preceding 20 years, from two to 20 occurring annually. The experiment was commenced on 1st November, 1902. Thirty-one cows were examined; seven of these—one of which had aborted—were in a field, and not under cover night or day. The remaining 24 were in byres, and of these two had cast calf. The pastures were old grass fields. Cows at grass were most subject. The sanitary conditions were good. All aborted animals were isolated, and not again bulled. The stage of utero-gestation at which abortion occurred varied from the second to the eighth month. The cows were put dry at the seventh month of pregnancy.

The following preventive measures were adopted:—The immediate isolation of all aborted animals, whose wombs were syringed out with a weak solution of bichloride of mercury and permanganate of potash, while in their food was given daily a small dose of sulphur and saltpetre. The byres disinfected. The pregnant stock also received sulphur and saltpetre in their food once a day—their vulvas regularly washed with a weak solution of permanganate of potash and bichloride of mercury. These preventive measures were continued to March, 1903. Five cases occurred in that period. On 13th March the pregnant cows were each given, every other day in their food, 15 grains of "Chinosol" in solution, and their vulvas washed daily with a solution of "Chinosol" (1—600). One case occurred in each month. On 18th May the use of "Chinosol" was discontinued. On 20th May a 10 minim perle of "Izal" was ordered each cow, thrice weekly. The other preventive measures continued until 28th November, three cases being reported. On 28th November all former preventives were stopped, and in their places one drachm doses of pure carbolic acid in solution, was given in food to each animal twice a week, and continued until 16th February. Two cases were reported. On 18th February "Entol" was substituted for carbolic acid and administered after the same manner as in experiment No. 2, and with the same success as at that centre.

CENTRE II.—The history and conditions were similar to that at Centre I. The preventive treatment was commenced on 1st September, 1903, and consisted of each pregnant cow receiving in food a dose of "Entol" twice a week, their vulvas washed twice a week with a solution of Jeyes' fluid



Rubber Vine (*Willughbeia Firma Blume*). This species supplies most of the Rubber produced in Borneo.

(1—100). From the time these preventive measures were started to 26th April, when the centre closed, no cows aborted. Such, then, are the salient points in last year's report.

For the experimental work this year two centres were selected, viz.: That previously referred to as Centre I. (Mr. Newton's farm), continued, and a new one opened at Mr. Perkins', Barkly. This centre was very similar to Centre I. at the outset, in that abortion was prevalent all the year round, but was worst when the cows were at grass. The preventive measures at both centres consisted of internal administration of "Entol" in solution twice a week to the cows, in their food, and the external application, twice a week of a 1—600 solution of "Chinosol" to their vulvas and surrounding parts. Most satisfactory results followed. At Centre I. three cows only aborted between April, 1904, and May, 1905. At Centre II. five cows only aborted between April, 1904, and May, 1905. The investigation from first to last has elicited several interesting points. Chief among these are:—

I. That at all three centres 50 per cent. of the total abortions occurred at the seventh month, and at the time when the cows were put dry. Why this should be is difficult at present to account for, but worth recording as information acquired of the character of the disease.

II. That the disease appears as much, if not more, in cows at grass as in those stall fed. Endeavouring to solve this mystery, where the surroundings in the former are so much more favourable to health than in the latter, has been a somewhat difficult task. Although it is not, at present, possible to give conclusive proof, I am satisfied new light has been thrown on the subject. Starting with the conviction of the origin of an outbreak being located in a particular field, or fields, on a farm, we arranged at No 1 centre that a given number of pregnant cows should be put on each grazing field and kept there for a definite period, no communication being allowed between each lot. After an interval of about three weeks one cow aborted in No. 1 field. She was immediately isolated from the others, the fœtus destroyed, and the pasture on which it lay disinfected. Being in doubt as to whether the case was sporadic or contagious, a healthy pregnant cow was placed in the hovel with the aborted cow. In three weeks she cast her calf. Two weeks after the first cow aborted, another cow aborted on No. 1 field. The other cows were now removed from the field, and a fresh lot put in; three weeks after one of these aborted. The cows that were removed from No. 1 field and put in another field carried their calves the full period. The evidence being conclusive as to the cause having its origin in the field, and that the abortion was of the contagious type, we next made a careful examination of the grasses, soil, and waters therein, but failed to discover any cause whatever, or solve the interesting question—Do the germs of contagious abortion have their origin in grasses, or in the soil from which the grass springs?

III. That preventive measures should be adopted immediately a cow becomes pregnant, and continued until she calves—one year's treatment not giving immunity from an attack when again pregnant.

IV. That bulls as a cause of abortion can only be so by acting as a medium, conveying the germs by copulating with cows which have aborted, and after with clean animals, the germ of abortion entering the generative organs of the female at the same time as the spermatozoa.

V. All cows showing signs of approaching abortion should be removed at once from amongst the other healthy pregnant stock. The byres should be disinfected. The fœtus when born, as also the cleansing, should be burned, the womb washed out twice a week with a solution of "Chinosol," and the animal receive in her food twice a week a dose of "Entol." The composition of "Entol" is: Iodine, 1 drachm; iodide of potash, 1½ozs.; carbolic acid, 1lb. The dose per animal of this mixture is—2 drachms in one quart of water, sprinkled over the food (chop) by means of a watering-can.

The following are extracts from letters received from Mr. Newton and Mr. Perkins, on whose farms two of the trial centres were established:—Mr. Newton, says: "During the 12 months previous to the time I first wrote you on the subject I had 34 cases of abortion. This took place in every field and in every shed we had, and in both cows and heifers alike. For the first six months we did not appear to receive much benefit, but after that we gradually began to see an improvement, which has continued until now. We feel confident in saying the disease is swept away, as we have not had a case for a long time. I fully believe it is no use anyone starting this treatment unless they are willing to lay themselves out for constant work and attention, as no results will be obtained by simply giving a few doses and then to cease. It must have perseverance." Mr. Perkins says: "When I think of the many losses we had amongst the cows, before starting with this treatment, owing to abortion, compared with the few since, I am pleased to say that I believe it has done us a great deal of good, and have great hopes that in time it will clear out the disease altogether."

GARDEN NOTES FOR JANUARY.

By Percy G. Wicken.

This is not the best time of the year for the vegetable garden. Where a supply of water is not available for irrigation, most of the more delicate plants will be feeling the effects of the dry weather. As soon as any plant ceases to be profitable or productive it should be pulled up and placed on the manure heap or destroyed. Old peas, cabbages, beets, etc., which have started to run to seed, are of no further use in the garden, and should be destroyed unless it is intended to save a few plants for seed. All weeds should be cut down before the seed becomes ripe, and by this means they can be kept in check. The number of seeds shed from one plant is enormous, and as many as 1,000 to 1,500 young plants, as the result of allowing a dock-weed to shed its seed, are not uncommon. Many weed plants will ripen their seed after

being cut down, if allowed to remain on the ground, and for this reason it is better to burn all weeds, or to place them on a compost heap, where the seeds will be destroyed. As soon as the ground becomes idle it should be dug up deeply and allowed to lie fallow until time for autumn planting takes place. The ground will then become well aerated and will be in better condition for growing vegetables than if allowed to remain in a hard-baked condition during the summer.

Cut-worms are particularly troublesome at the present time, they eat the leaves and stems of plants and often cause the stem to break off and the plant dies; they are generally to be found in the ground close round the stem of the plant and if the ground is disturbed may be easily found; they are a brownish colour, somewhat the same as the soil. Constant stirring of the soil helps somewhat to keep them in check, as also does liming the soil with caustic lime; but the most effective way to destroy them is to spray with a mixture of Paris green and water at the rate of 1oz. of Paris green to 10 gallons of water. First mix the Paris green to a paste and then add the water, spray the plants on both sides of the leaves and keep the mixture well stirred while using.

If the black rot appears among the tomatoes, the plants should be tied up to stakes to keep the fruit off the ground and all diseased fruits should be picked and burned.

The early tomatoes coming into market are rather badly affected with grubs; these might be kept in check and the condition of the fruit considerably improved if sprayed earlier in the season with Bordeaux mixture to which a little Paris green has been added. If the ground is kept well stirred, in addition to helping to conserve the moisture, the attacks of insect pests are kept in check, as the turning up to the sun of many insects in their immature state destroys them.

Beans.—Any kind of the summer-growing beans may be sown where the ground is sufficiently moist to germinate the seed. Beans should not be sown on the same ground as they were grown in the previous year, but this ground should be reserved for root crops, or some other tribe that will make use of the nitrogen collected from the air by these leguminous plants.

Madagascar beans are prolific bearers, and grow well in the hottest weather. They are somewhat strong in flavour, but are relished by many people.

Lima beans are one of the most delicious of the bean tribe, but have been very little cultivated in this State. The Black Pole Lima will stand a great amount of heat and drought. The white seeded varieties are the best for table and bear well.

Beet (Silver).—This is one of our most valuable summer plants; in many gardens it is the only thing that continues to give a supply of green leaves when all else is dried up. It is valuable both for table and for providing green food for poultry and other farm stock. It is late for sowing now, except in exceptionably favourable localities, but large quantities should be sown earlier in the season. If the outer leaves are cut off as required it will continue to send out leaves from the centre for some months.

CABBAGE.—Keep those already up well cultivated and give them a little liquid manure if available. A little seed may be planted in a shady place to keep up a supply of plants.

CELERY.—Earth up any plants that are well forward, but care must be taken not to let any earth get into the hearts.

CHOKOS.—Those planted early in the season should now have climbed over the trellis and be bearing young fruits. The best way to cook chokos is to boil for a short time until soft and then bake with the meat.

CUCUMBERS.—Are now plentiful and cheap. In moist situations a further supply of seed may be sown, but the holes should be deeply worked and the young plants shaded by a few bushes as soon as they break the ground.

EGG PLANT.—If enough plants are not out a few more may be transplanted, but they will require to be well shaded, and are not likely to yield so well as the early sown ones.

MAIZE.—The cultivator should be kept going between the rows of Maize already up and the earth should be hilled up towards the plants. A few more rows may be sown in moist situations. The cobs should be picked before they become hard, if required for table use.

MELONS.—Should be fit for market. Pick out a few of the best of each kind, true to name, and mark them with a knife for seed; the marks will soon show and they can then be reserved.

OKRAS.—If required for pickles the pods should be picked while green; if seeds are required allow the pods to become dry before picking.

ONIONS.—A little seed may be sown for garden purposes if water is available and any young plants put out. The main crop should now be fit for market.

PUMPKINS AND SQUASHES.—All the early varieties should be ripe by now, and supplies will be plentiful; keep the cultivator going between the rows until the vines cover the ground. A few more of the quick-growing bush varieties of squashes may be sown in moist localities to provide for a late supply.

SWEET POTATOES.—Early planted shoots should now be making a good growth; as soon as the runners have become strong, the plants, unless planted on hills, should be hilled up and the centres between the hills kept well cultivated; this can be done by a special attachment to the cultivator, which lifts the vines.

TOMATOES —The market is fairly well supplied with tomatoes, but the quality is inferior. Good prices can be obtained for first-class, smooth-skinned fruit, free from disease, and growers should select only good varieties when sowing and obtain their seed from a reliable source. Tomatoes should not be planted on the same ground two seasons running, and should not follow after the potato crop, as they belong to the same species. All plants should be staked as soon as high enough, so as to keep them off the ground. A few more young plants can be put out if well shaded and watered.

FARM.—Harvesting in the field, except in a few late localities, will be over before these Notes appear. There will remain, however, plenty of work in thrashing, winnowing, chaff-cutting, etc., before the crop is ready for market. These operations, although not so urgent as the getting the crop in from the field, require to be carried out as soon as possible. Those who intend to keep their hay until later in the season should get their stacks thatched as soon as possible, so as to protect it from any chance storms that may occur and also to plough a fire-break round the stack so as to protect it from bush fires. As the harvesting machinery is finished with it should be thoroughly cleaned and given a good coat of oil before being put away; more machinery is ruined by exposure and neglect than is worn out harvesting the crop. Before the wheat is sent off the farm it will pay to run it through a grader, as a better sample can be secured and a higher price obtained, especially if the best sample can be sold for seed. Any surplus straw should be stacked and saved for the winter, when it will form a valuable addition to the feed for the store stock when grass is scarce. Potatoes have given fairly good returns, but the proportion lost by disease still continues to form a large percentage of the crop. This is due in some respect to the seed obtainable being so weakened by excessive propagation that it is very susceptible to disease, and also in a great measure to the lack of precautions to prevent attacks of insect pests. If the tops were sprayed with Bordeaux mixture before any signs of disease occur it would help to keep diseases in check. Most people wait until the attack is so bad that the crop is almost lost before they take any steps to spray the plants. The increased vigour of the plant can only be secured by the raising of new varieties from seed and not from tubers, and this is a business of itself. Onions are a most profitable crop, and why they are not more extensively grown is a question hard to answer. They certainly require care and attention, but the returns are sufficient to pay for the labour. At Northam this season the average return from one garden has been eight tons per acre, and there were several acres under this crop; the price has been from £15 to £20 per ton, and at times higher, consequently this ought to make the crop a profitable one to grow.

Bot-flies become troublesome at this time of the year. Once the larvæ of the fly get into the intestines of the horse very little can be done to dislodge them, consequently the only thing to do is to prevent the larvæ from obtaining entrance. The bot-fly lays its eggs on the jaw and shoulder of the horse, the animal licks them off, and the eggs hatch out in the stomach of the animal. If the jaw and shoulder of the horse are well washed every night and rubbed with carbolised oil it will prevent the fly from laying its eggs, as the smell is objectionable to it. When the eggs are swallowed the grub hatches out and attaches itself to the intestines of the animal and feeds on the juices in the stomach, often causing the loss of the animal.

LOCAL MARKETS' REPORTS.

MESSRS. H. J. WIGMORE & CO.'S REPORT.

Messrs. H. J. Wigmore and Co., of Fremantle, Kalgoorlie, and Northam, report as follows in connection with their daily auction sales of chaff and grain at Perth and Fremantle railway yards for month ending 8th inst. :—

Chaff.—During the month market conditions have had a see-saw tendency. Up till the beginning of last week deliveries of chaff were extremely heavy, weekly supplies averaging about 160 trucks, and prices of course suffered accordingly, prime green wheaten selling down as low as £3 15s. per ton. These low prices, combined with the fact that stripping operations are now in full swing, and chaff bags at an abnormally high figure, naturally had the effect of inducing farmers to hold back their supplies, and last week a total of only 49 trucks was recorded. Consequently, as it is merely a question of supply and demand, prices have again advanced, and present value for prime wheaten may be stated at £4 10s. to £4 12s. 6d. We do not anticipate, however, that these prices will be long maintained, as there are already indications of producers forwarding their supplies in more freely to catch present good market, and with heavy yardings prices must again fall. During the glut storing operations were freely indulged in, and this we think is without precedent at this time of the year, as in all previous years storing did not become general until February. However, those well informed contend, that with no chaff carried over from last season, stocks will not be heavy, and prices will rise still further this side of Christmas. On the other hand, others, who also should know, contend that supplies will now come forward heavily, at all events more than sufficient for requirements, say until towards the end of February and the beginning of March. Our advices from week to week are such that incline us to the latter view. The position taken in either light is highly speculative, and cannot be foreshadowed with any degree of certainty. Mild weather has continued to prevail during the past month, with only a day or two of real early summer atmosphere; hence, though there is an abundance of feed, the nourishing properties are wanting, and good inquiries have prevailed for inferior grades for stock feeding. The inquiry, as a matter of fact, has been so good, that cow chaff, generally £2 to £2 10s. below prime green wheaten, has crept up in price within £1 and 25s. of first-class feed. Strange to relate that the month of November should have passed without similar supplies from Pingelly, Seabrook, Newcastle, Moojebing, and Woodanilling as prevailed during November of 1904, and producers, when forming an opinion as to the probable state of the market towards Christmas and early January, should take this factor into consideration. Undoubtedly supplies are bound to come forward from these districts, as we understand the harvest has been good there. Closing rates are:—Prime green wheaten, £4 10s.; f.a.q. wheaten, £4 2s. 6d. to £4 7s. 6d.; good medium wheaten, £4; medium and inferior grades from £3 upwards, according to quality and condition.

Wheat.—Before the advent of new season's stuff this commodity reached as high as 4s. 7d., but during the last week or two supplies of new season's wheat have been arriving in enormous quantities, and price has come back daily, until to-day value may be stated at 3s. 9½d. to 3s. 10d. Indeed, several trucks were passed in yesterday at the former figure. This barely exceeds country equivalent, and with a continuance of heavy deliveries a further decline is bound to occur.

Flour.—We have to report a drop in the price of Thomas' Adelaide "Standard," this brand now being quoted f.o.b. £7 17s. 6d. sacks, £8 2s. 6d. quarters. For Thomas & Co.'s Northam "Standard," prices remain the same as in our last report, viz., £8 5s. sacks prompt delivery, £8 10s. forward contracts; quarters 5s. extra in each instance.

Oats.—The trade are now looking forward to supplies of the locally-grown article. They are not coming in freely at the present moment, however, only three trucks being to hand to date; closing price being for good feed 2s. 6½d., which figure we secured this week. Victorian Algerians have receded to 1s. 11d. f.o.b., with a falling market, but as the crop in Victoria is late this season, we do not anticipate the price ruling lower until January. It is quite likely that a 1s. 6d. market will be available during that month.

Bran and Pollard.—Supplies short. Bran nominally worth £7 5s. Pollard £8 on spot. The "Hobart" and "Yongala," arriving next week, however, bring heavy supplies, and we quote ex these vessels £6 10s. bran, £7 15s. pollard.

Kalgoorlie Chaff Report.

Our Kalgoorlie office reports short supplies during the past week, and market for prime green wheaten is firm at £5 per ton. These light deliveries have acted beneficially in the direction of reducing congested stocks, which accumulated during the excessive glut of two weeks back, and they state that the market is now in a position to receive consignments on a reasonable scale. For medium and inferior grades, demand continues small.

DALGETY'S WEEKLY REPORT.

Messrs. Dalgety and Co., Ltd., report as follows in connection with the produce markets:—

Wheat.—Our London office informs us by cable of even date that no change can be reported in the price of wheat. Buyers are cautiously buying in view of the uncertainty of the markets. Shipments of wheat from Russia, despite the recent disturbances, continue to be heavy, and, taking into calculation the extra heavy consignments for Europe from Canada and the United States, it is anticipated the price will keep down. Cargoes are offered at 33s. to 33s. 5d. per quarter for January shipments, but buyers are not responding. Wheat in the Eastern States continues even with prices quoted last week, but the market appears easier, more especially in Melbourne, where old wheat is now quoted at 3s. 5d. per bushel; new wheat for December delivery at 3s. 4d. per bushel; new wheat for January delivery at 3s. 3d. to 3s. 3½d. per bushel. In Adelaide old wheat was sold at 3s. 7d. per bushel; new wheat for delivery all through December at 3s. 4d. per bushel.

Local Wheat.—During the week consignments have been arriving daily, the market receding in consequence. Prices have been reduced from 4s. 5d. to 3s. 9½d. and 3s. 10d. per bushel, at which prices sales were made during the present day. Farmers have completely flooded the market with their consignments, and in consequence there is no option for the agents than to dispose of to the highest bidder. Merchants appear to have filled their present demands, with every probability of a further decline to be experienced at a very early date. Millers in the eastern districts appear to have been purchasing on a very heavy scale at very advanced figures, and in consequence have readily filled their demands at the advanced rate. Wheat, in consequence, has no option but to recede during the coming months, some millers standing off completely from the high prices offered for the various quantities for sale.

Chaff.—The chaff market throughout the week has experienced several changes, but on the latter days of the week was firm for prime green samples, instances of £4 12s. 6d. being noted at the various sales, but £4 10s. per ton being about the ruling rate for the primest samples at the auctions during the latter days of the week. The consignments throughout the whole period have been of a limited nature, owing to most of the farmers being busy with stripping operations, and in consequence could not spare the time to cart their chaff to rail. Ruling rates are as follow:—Prime green wheaten, £4 7s. 6d. to £4 10s., occasionally £4 12s. 6d., per ton; f.a.q. wheaten, from £4 2s. 6d. to £4 5s. per ton; good sound medium, from £3 17s. 6d. to £4; inferior, from £2 per ton upwards, according to sample.

Oaten Chaff.—Several trucks have arrived during the week, and for samples submitted prices obtained have been from £4 7s. 6d. to £4 12s. 6d. per ton, according to sample. The demand is fairly good, but we anticipate the present ruling rate will recede at an early date.

Straw at the present time is very short on spot. The demand is excellent, with no notifications of immediate supplies.

Algerian Oats.—The market in the Eastern States has been on the slight decline throughout the week, and at the later end have been quoted firm at 2s. 6½d. to 2s. 7½d. per bushel, whole and crushed, f.o.r. Fremantle. Stocks on spot are short, and will be replenished by the shipment due ex. ss. "Hobart" on the 12th or 14th inst. During the week the first consignment of local Algerian oats came forward to Perth, and was sold at 2s. 6d. per bushel. The oats proved to be of a fair sample, but competition for same was dull.

Potatoes.—The potato market appears to have been fluctuating of late, and at times were scarce on spot, but at the latter end of the week the supply was fully up to the demand; prices in consequence have also fluctuated in sympathy, and potatoes sold on even date returned £10 10s. per ton.

Chaff Report.—Since Monday last the daily arrivals have been very light, and prices have firmed considerably, the present demand being very keen for prime samples. We consider present prices:—Prime green wheaten, £5 5s. per ton; extra samples, a little more; good qualities, worth up to £5 per ton; medium samples, about £4 15s. per ton. We would recommend growers to send immediate consignments of a light nature.

Stock and Station Report.

Messrs. Dalgety and Co., Ltd., report in connection with their monthly stock markets as follows:—

Pingelly Sale (held on Friday, December 1).—A fairly good yarding of stock came forward for sale, and as there was a good attendance of buyers a clearance of the sheep-yards was made, with the exception of one pen of 25 fat wethers, on which the owner had put a prohibitive reserve. Ewes were in keen demand, and bidding on these was animated. We quote the following prices realised:—Fat wethers, 16s. to 17s. 6d.; fat ewes, 15s.; two-tooth breeding ewes, 17s.; aged ewes, 12s.; lambs, 10s. to 10s. 8d. Pigs—Store pigs, 13s.; weaners, 6s. Horses—None sold. Next Pingelly sale will be held on Tuesday, January 9, 1906.

Beverley Sale (held on Thursday, November 30).—A good yarding of sheep, cattle, and horses was offered, and a good attendance of farmers and buyers put in an appearance. The market for sheep is still a bit weak compared with the prices ruling a month or two ago. We quote the following:—Fat wethers, 16s. to 17s.; full-mouth ewes, 13s. 8d.; store wethers, 14s. 6d.; lambs, 10s. 6d.; crossbred rams, 24s. to 27s.; half Shropshire rams, 34s. to 36s. Cattle—Cows, to £7 15s.; steers, £4. Horses—Draughts, to £25; medium draughts, £14 15s. Poultry—Ducks, 5s. per pair; roosters, 4s. per pair. Next sale at Beverley will be held on Tuesday, December 19, when our first combined sale with Messrs. Elder, Shenton & Co. will take place at their yards.

Hides, Skins, Tallow, etc.

Messrs. Dalgety and Co., Ltd., report having held their usual weekly sale at their Fremantle stores, Cliff-street, on Friday, December 8:—

Wool.—A fair offering was submitted, and good competition was experienced, buyers bidding freely up to late quotations, but in many instances owners' values were not reached, consequently withdrawals were frequent. Fine crossbred and merino fleece (super quality), none offering, nominal value to 10d.; fine crossbred and merino fleece (good quality), 9½d. to 9¾d.; fine crossbred and merino (medium quality), 8½d. to 9¼d.; fine crossbred and merino fleece (inferior quality), 6½d. to 8d.; coarse and medium crossbred fleece, 7½d. to 8¼d.; lambs, 7d. to 7½d.; bellies and piece, 4d. to 6½d.; locks, 1½d. to 3d.

Sheepskins.—Light supplies forward, late values were fully maintained, and we cleared all offering at prices which should be satisfactory to owners. Good fine crossbred and merino, three-quarter to full wool, 7¾d. to 8d.; red and earthy fine crossbred and merino, three-quarter to full wool, 7½d. to 7¾d.; good fine crossbred and merino, one-half to three-quarter wool, 7½d. to 7¾d.; red and earthy fine crossbred and merino, half to three-quarter wool, 6¾d. to 7¼d.; good fine crossbred, quarter to half-wool, and merino, 6½d. to 7d.; red and earthy fine crossbred and merino, quarter to half-wool, 6¼d. to 6½d.; coarse and medium crossbred, three-quarter to full wool, 7d. to 7½d.; pelts, crossbreds, and merinoes, 6d. to 6¼d.; pelts, shearlings, 5½d. to 6d.; lambs (spring), to 7¼d. In all cases where pelts of above are sun-dried, weevil-eaten, torn, or perished, prices are from 1d. to 2d. per lb. below quotations.

Hides.—Offerings to-day consisted of some lines in first-class condition, and meeting strong competition, the highest prices yet realised in this market were readily obtainable. We quote a further rise of fully ¼d. per lb. Heavies, to 5½d.; medium and light, 5d. to 5½d.; medium and light (dirty condition), 4¾d. to 5d.; dry, 4¾d. to 5¾d.; damaged and cut, 4d. to 4¾d.; ticky, 4½d. to 4¾d.

Kangaroo Skins.—Moderate offerings were again submitted at to-day's sale, and the higher values lately reported were fully maintained, the catalogue being cleared at full quotations. Three-quarter to one and a-half lb. average, 2s. 4d. to 2s. 6½d.; one and three-quarters to two lb. average, 1s. 10d. to 2s. 1d.; extra heavy and very light weights 1s. 4d. to 1s. 10d.; damaged lines, 1s. 3d. to 2s. 2d.; Euro skins, 1s. 3d. to 1s. 9d.; brush kangaroos, to 1s. 4d.; wallaroos, 1s. 6d. to 1s. 9d.

Opossum Skins, Tallow, Horns, Hair, etc.—Supplies continue light, a keen demand existing for all descriptions. Opossum skins—Good greys and reds, 8s. to 9s. per dozen average; fair greys and reds, 7s. 6d. to 8s.; blacks, 15s. to 17s.; blacks (inferior), 9s. Tallow—Good mixed in casks (none forward), 20s. to 21s. 6d. per cwt.; inferior mixed in casks, 18s. to 20s.; medium mixed tins and oddments, 18s. to 21s. Horns, Hair, etc.—Horns, in fresh condition, 35s. per 100; horns, in stale condition, 25s. per 100. Horsehair, 1s. 4d. per lb. Cowhair, 6d. per lb. Rough bones, 3s. 6d.

THE CLIMATE OF WESTERN AUSTRALIA DURING NOVEMBER, 1905.

The weather has been of a fair average character throughout. The mean pressure, temperature, and rainfall are about the same as for previous years, though rather cooler than usual in coastal districts and rather warmer inland.

The first real touch of summer was felt in the Southern portions of the State generally on 21st November, when the temperature at the Observatory rose to 96·3°. This was due to the passage of a "low" from the North-West coast overland, through the Murchison and Coolgardie Goldfields to the South coast, and was followed by a cool change and light coastal showers. High temperatures were at times experienced throughout the interior, every station from Southern Cross and Coolgardie northwards recording over 100° as the maximum for the month, and Marble Bar taking the record with 116·4.

The Climate of Western Australia during November, 1905.

Region	Locality.	Barometer (corrected and reduced to sea-level). Mean of 9 a.m. and 3 p.m.	Barometer: Average for previous years.	Barometer: Highest for Month.	Barometer: Lowest for Month.	Shade Temperatures. November, 1905. Mean Max.	November, 1905. Mean Min.	November, 1905. Mean of Month.	November, 1905. Highest Max.	November, 1905. Lowest Min.	* Average for previous Years. Mean Max.	* Average: Mean Min.	* Average: Highest ever recorded.	* Average: Lowest ever recorded.	Rainfall. Points (100 to inch) in Month.	Rainfall. Wet Days.	Rainfall. Total Points since Jan. 1.
North-West and North Coast:	Wyndham ...	...	29·852	30·020	...	98·1	80·7	89·4	107·5	71·0	98·5	80·9	111·6	69·2	133	2	1,248
	Derby ...	29·908	29·860	30·058	29·752	98·6	75·2	86·9	110·0	66·8	91·4	76·9	112·5	68·0	17	1	1,499
	Broome ...	29·923	29·868	30·039	29·791	92·8	95·3	84·0	107·4	67·2	93·0	76·0	111·0	67·8	3	1	697
	Condon ...	29·911	29·870	30·101	29·762	92·7	67·7	80·2	102·8	55·6	94·6	63·7	112·8	49·2	*Nil*	...	996
	Cossack ...	29·910	29·875	30·192	29·780	97·5	69·5	83·5	108·0	62·8	97·8	71·4	111·7	57·6	*Nil*	...	763
	Onslow ...	29·950	29·895	30·115	29·789	93·1	65·1	79·1	108·0	58·2	93·9	65·3	110·0	50·0	*Nil*	...	607
	Winning Pool	29·946	...	30·125	29·770	96·5	62·7	79·6	105·8	58·4	...	...	...	...	*Nil*	...	843
	Carnarvon ...	30·014	29·972	30·232	29·826	79·3	64·8	72·0	96·0	60·0	81·9	65·0	109·1	50·4	*Nil*	...	1,032
	Hamelin Pool...	30·001	29·948	30·223	29·812	87·8	56·9	72·4	95·2	51·6	89·6	60·3	109·0	46·6	*Nil*	...	754
	Geraldton ...	30·050	30·015	30·310	29·870	76·0	58·0	67·0	83·0	49·0	76·9	57·7	103·8	45·0	6	3	1,989
Inland:	Hall's Creek ...	...	29·895	...	...	...	...	...	...	...	100·8	74·6	109·0	56·4	112	5	696
	Marble Bar ...	...	...	...	...	105·8	71·9	88·8	116·4	64·8	105·1	72·8	113·8	59·2	*Nil*	...	895
	Nullagine ...	29·878	29·834	30·120	29·685	102·2	67·3	84·8	114·0	55·0	101·8	69·7	111·8	52·0	*Nil*	...	577
	Peak Hill ...	29·890	29·862	30·150	29·640	91·2	67·0	84·1	106·0	54·0	94·1	67·2	106·5	45·4	*Nil*	...	484
	Wiluna ...	29·866	29·846	30·281	29·621	95·4	64·0	79·7	107·0	50·0	92·4	63·4	106·0	38·5	1	1	541
	Cue ...	29·932	29·906	30·240	29·645	92·5	61·7	77·1	103·2	51·2	93·3	63·1	108·2	45·0	*Nil*	...	706
	Murgoo ...	...	...	...	...	90·9	61·1	76·0	102·0	51·4	...	...	...	...	*Nil*	...	511
	Yalgoo ...	29·934	29·928	30·259	29·697	90·7	57·7	74·2	101·8	48·0	91·1	59·4	107·7	42·8	*Nil*	...	974
	Lawlers ...	29·921	29·906	30·349	29·684	93·0	61·7	77·4	105·8	49·0	90·7	63·6	105·4	41·1	1	1	689
	Laverton ...	29·926	29·933	30·402	29·625	91·2	61·8	76·5	104·8	48·2	90·6	63·0	105·6	42·7	237	1	926
	Menzies ...	29·912	29·927	30·346	29·572	90·8	60·3	75·6	105·2	45·8	88·8	61·1	105·0	39·3	57	1	610
	Kanowna ...	...	...	...	...	87·3	55·2	71·2	106·0	45·0	...	...	...	...	26	2	564
	Kalgoorlie ...	29·949	29·954	30·402	29·568	89·2	57·8	73·5	107·8	45·8	87·1	58·6	107·1	40·6	17	2	546
	Coolgardie ...	29·940	29·954	30.402	29·577	87·9	56·0	72·0	107·2	43·4	86·7	57·2	106·5	39·3	20	3	666
	Southern Cross	29·950	29·946	30·415	29·722	89·1	55·9	72·5	109·0	42·2	87·5	55·3	108·5	37·8	8	2	633
	Kellerberrin ...	...	...	...	...	...	...	...	...	...	...	...	...	...	33	2	1,189
	Walebing ...	...	...	...	...	80·4	51·3	65·8	99·0	39·4	80·9	52·0	108·8	36·4	26	4	2,068
	Northam ...	...	...	...	...	81·9	53·0	67·4	100·9	39·5	83·8	53·6	109·1	38·3	39	7	2,019
	York ...	30·024	30·004	30·420	29·972	80·9	52·2	66·6	101·7	37·6	83·1	52·8	110·2	39·2	55	6	2,161
	Guildford ...	...	...	...	...	77·7	55·8	66·8	99·0	43·8	79·8	54·8	106·2	40·7	78	7	3.467

The Climate of Western Australia during November, 1905—*continued.*

Locality.		Barometer (corrected and reduced to sea-level). Mean of 9 a.m. and 3 p.m.	Average for previous years.	Highest for Month.	Lowest for Month.	Shade Temperatures. November, 1905. Mean Max.	Mean Min.	Mean of Month.	Highest Max.	Lowest Min.	Average for previous Years. Mean Max.	Mean Min.	Highest ever recorded.	Lowest ever recorded.	Rainfall. Points (100 to inch) in Month.	Wet Days.	Total Points since Jan. 1.
South-West and South Coast:	Perth Gardens	30·041	30·024	30·413	29·775	76·9	58·2	67·6	98·0	45·5	75·9	57·1	105·0	41·0	60	7	3,330
	Perth Observatory ...	30·050	30·034	30·428	29·805	73·4	56·4	64·9	96·3	45·9	75·0	56·4	100·9	42·0	69	8	3,384
	Fremantle	30·077	30·040	30·439	29·812	71·9	58·6	65·2	98·2	47·0	72·0	58·0	96·4	42·5	51	7	2,684
	Rottnest	30·070	30·018	30·428	29·793	70·2	58·3	64·2	91·0	50·0	71·1	59·2	96·2	48·6	37	7	2,499
	Mandurah	...	...	...	...	73·5	53·8	63·6	96·3	41·0	76·4	53·8	98·4	36·9	90	9	4,180
	Marradong	...	...	...	...	...	...	...	...	...	...	...	...	...	73	9	3,365
	Wandering *	...	...	...	...	74·0	46·2	60·1	102·6	39·0	78·3	46·2	105·0	35·8	177	7	3,460
	Narrogin	...	...	...	...	75·0	49·4	62·2	98·5	31·3	...	...	...	...	52	4	2,534
	Collie	...	...	...	...	74·3	49·1	61·7	94·0	35·7	76·1	47·8	99·8	35·9	153	9	4,033
	Donnybrook *	...	...	...	...	73·2	51·1	62·2	88·8	36·4	75·5	49·3	97·8	36·9	130	8	4,111
	Bunbury	30·062	30·048	30·416	29·722	71·7	54·2	63·0	92·4	39·0	73·3	52·9	97·2	39·3	71	8	3,673
	Busselton	...	...	...	...	72·3	51·4	61·8	89·8	40·2	74·0	50·3	92·8	39·2	64	9	2,953
	Cape Naturaliste ...	30·049	...	30·410	29·667	68·3	54·6	61·5	86·3	47·0	...	...	...	...	63	8	2,864
	Bridgetown	...	...	...	...	75·0	47·7	61·4	97·0	35·0	75·1	46·8	98·0	35·6	114	10	3,389
	Karridale	30·060	30·054	30·410	29·670	70·3	53·5	61·9	89·3	42·4	70·0	52·0	95·0	36·9	124	12	4,477
	Cape Leeuwin	30·010	30·012	30·393	29·508	68·4	57·5	63·0	74·0	49·0	68·1	52·1	95·0	38·0	89	15	3,742
	Katanning	30·012	30·010	30·386	29·698	76·2	49·6	62·9	104·0	39·0	78·1	49·4	106·0	37·0	54	5	2,276
	Mt. Barker	...	...	...	...	71·5	47·1	59·3	96·4	36·9	...	...	...	...	101	8	2,923
	Albany	30·026	30·032	30·384	29·580	68·6	51·7	60·2	82·5	40·8	68·7	52·5	93·5	40·6	159	13	3,843
	Breaksea... ...	30·030	30·028	30·410	29·547	64·1	55·4	59·8	74·0	46·0	65·4	54·9	85·0	43·3	143	14	3,592
	Esperance	30·010	30·030	30·407	29·608	74·2	53·1	63·6	104·0	39·5	73·3	54·5	105·0	39·2	107	4	2,392
	Balladonia	30·015	30·030	30·446	29·520	83·7	50·7	67·2	102·7	40·0	30·7	51·3	106·4	40·6	16	3	611
	Eyre	29·998	30·032	30·360	29·466	83·8	52·5	68·2	104·9	35·5	74·0	54·6	108·1	34·5	40	1	650
INTERSTATE.																	
Perth		30·050	30·034	30·428	29·805	73·4	56·4	64·9	96·3	45·9	75·0	56·4	100·9	42·0	69	8	3,384
Adelaide		30·025	30·023	30·411	29·570	75·5	51·1	63·3	92·4	42·0	79·0	55·4	113·5	40·9	15	3	2,242
Melbourne		29·957	29·875	30·303	29·563	71·0	49·6	60·3	93·5	41·5	91·3	50·9	105·7	36·5	125	9	2,488
Sydney		29·970	29·981	30·320	29·590	77·0	59·0	68·0	98·0	46·0	74·2	59·6	102·7	46·2	63	4	3,230

* Averages for three years only.

The Observatory, Perth, 8th December, 1905.

W. E. COOKE, Government Astronomer.

RAINFALL for October, 1905 (completed as far as possible), and for November, 1905 (principally from Telegraphic Reports).

Stations.	October.		November.	
	No. of points. 100 = 1in.	No. of wet days.	No. of points. 100 = 1in.	No. of wet days.
East Kimberley:				
Wyndham	34	3	133	2
6-Mile	40	1	160	2
The Stud Station ...	...	...	...	...
Carlton	...	...	...	...
Denham	...	...	...	...
Rosewood Downs ...	...	...	...	...
Argyle Downs ...	...	...	...	...
Lisadell	..	...	...	...
Turkey Creek ...	12	2	189	4
Ord River	...	...	...	...
Alice Downs ...	..	...	...	...
Hall's Creek ...	13	3	112	5
Nicholson Plains ...	...	...	...	...
Flora Valley ...	...	...	...	...
Ruby Plains ...	...	...	...	..
Denison Downs ...	...	...	...	...
West Kimberley:				
Obagama	Nil	...	...	...
Beagle Bay ...	Nil	...	...	...
Pt. Torment ...	Nil	...	...	...
Derby	Nil	...	17	1
Yeeda	...	...	...	...
Liveringa	...	...	...	...
Mt. Anderson ...	...	...	...	...
Leopold Downs ...	...	...	...	...
Fitzroy Crossing ...	Nil	...	58	5
Fitzroy (C. Blythe)	Nil	...	...	...
Quanbun	Nil	...	...	...
Nookanbah ...	...	...	...	...
Broome	Nil	...	3	1
Roebuck Downs ...	...	...	...	...
Thangoo	...	...	...	...
La Grange Bay ...	Nil	...	Nil	...
North-West:				
Wallal	Nil	...	Nil	...
Condon	Nil	...	Nil	...
Pardoo	Nil	...	...	...
DeGrey River ...	Nil	...	...	...

Stations.	October.		November.	
	No. of points. 100 = 1in.	No. of wet days.	No. of points. 100 = 1in.	No. of wet days.
North-West—cont.				
Port Hedland ...	1	1	Nil	...
Boodarie ...	...	...	...	...
Warralong ...	Nil	...	..	..
Muccan	...	...	...	...
Ettrick	Nil	...	...	...
Mulgie	Nil	...	...	...
Eel Creek ...	...	...	...	...
Station Peak ...	Nil	...	...	...
Coongon	Nil	...	...	...
Warrawagine ...	...	...	...	...
Bamboo Creek ...	Nil	...	2	1
Marble Bar ...	Nil	...	Nil	...
Warrawoona ...	Nil	...	Nil	...
Corunna Downs...	Nil	...	...	...
Nullagine ...	Nil	...	Nil	...
Mt. Edgar ...	...	...	...	...
Kerdiadary ...	Nil	...	...	...
Roy Hill	...	...	...	...
Middle Creek ...	Nil	...	...	...
Mosquito Creek...	...	...	...	...
Mulga Downs ...	Nil	...	...	...
Woodstock ...	...	...	...	...
Mt. Florence ...	Nil	...	...	...
Tambrey ...	Nil	...	...	...
Millstream ...	Nil	...	...	...
Yandyarra ...	...	...	...	...
Mallina	Nil	...	..	...
Whim Creek ...	Nil	...	Nil	...
Cooyapooya ...	...	...	...	...
Woodbrooke ...	Nil	...	...	...
Croydon	Nil	...	...	...
Balla Balla ...	...	...	...	...
Roebourne ...	Nil	...	1	1
Cossack	Nil	...	Nil	...
Sherlock ...	...	...	...	...
Fortescue ...	Nil	...	Nil	...
Mardie	Nil	...	...	...
Mt. Stewart ...	...	...	...	...
Yarraloola ...	Nil	...	...	...
Chinginarra ...	...	...	...	...
Onslow	Nil	...	Nil	...
Peedamullah ...	Nil	...	...	...
Red Hill	Nil	...	...	...
Mt. Mortimer ...	...	...	...	...
Peake Station ...	Nil	...	...	...
Wogoola ...	...	...	...	...

RAINFALL—*continued.*

Stations.	October.		November.	
	No. of points. 100 = 1in.	No. of wet days.	No. of points. 100 = 1in.	No. of wet days.
North-West—*cont.*				
Nanutarra ...	Nil	...	...	...
Yanrey	Nil	...	...	...
Point Cloates ...	...	...	...	...
Edmunds ...	Nil	...	...	...
Gascoyne:				
Winning Pool ...	Nil	...	Nil	...
Coordalia ...	Nil	...	...	...
Towara	Nil	...	...	...
Ullawarra ...	...	...	...	...
Maroonah ...	...	...	...	...
Gifford Creek ...	Nil	...	...	...
Bangemall ...	...	...	...	...
Mt. Augustus ...	...	...	...	...
Minnie Creek ...	...	...	...	...
Yanyeareddy ...	Nil	...	...	...
Williambury ...	...	...	...	...
Booloogooroo ...	...	...	...	...
Wandagee ...	...	...	...	...
Bernier Island ...	...	...	...	...
Boolathana ...	...	...	...	...
Carnarvon ...	Nil	...	Nil	...
Brick House ...	1	...	...	...
Doorawarrah ...	...	...	...	...
Bintholya ...	...	...	...	...
Mungarrah ...	Nil	...	...	...
Clifton Downs ...	...	...	...	...
Dairy Creek ...	...	...	...	...
Upper Clifton Downs	...	...	...	...
Dirk Hartog Island	...	...	...	...
Sharks Bay ...	8	1	Nil	...
Kararang ...	...	...	...	...
Meedo	20	1	...	...
Tamala	...	...	...	...
Wooramel ...	15	2	Nil	...
Hamelin Pool ...	9	2	Nil	...
Byro	Nil	...	...	...
Yarra Yarra ...	Nil	...	...	...
Berringarra ...	...	...	...	...
Mt. Gould ...	Nil	...	...	...
Moorarie ...	14	2	...	...
Wandary ...	...	...	...	...
Peak Hill ...	30	2	Nil	...
Mt. Fraser ...	...	...	...	...
Abbotts	10	1	Nil	...
Belele	...	...	...	...

Stations.	October.		November.	
	No. of points. 100 = 1in.	No. of wet days.	No. of points. 100 = 1in.	No. of wet days.
Gascoyne—*contd.*				
Mileura	Nil	...	...	...
Milly Milly ...	Nil	...	Nil	...
Manfred ...	4	3	Nil	...
New Forest ..	Nil	...	...	...
Woogorong ...	Nil	...	Nil	...
Boolardy ...	...	...	...	...
Twin Peaks ...	...	...	...	...
Billabalong ...	Nil	...	...	...
Wooleane ...	Nil	...	...	...
Woolgorong ...	3	2	...	...
Murgoo	4	1	Nil	...
Yallalonga ...	...	..	...	...
Meka ...	...	...	...	...
Mt. Wittenoom...	...	...	...	...
Nannine	7	1	Nil	...
Star of the East	Nil	...	Nil	...
Annean	...	...	...	...
Tuckanarra ...	Nil	...	Nil	...
Coodardy ...	Nil	...	...	...
Cue	3	1	Nil	...
Day Dawn ...	Nil	...	Nil	...
Lake Austin ...	4	2	Nil	...
Lennonville ...	5	2	Nil	...
Mt. Magnet ...	4	2	Nil	...
Challa	Nil	...	...	...
Youeragabbie ...	...	...	...	...
198 Mile... ...	...	...	5	1
Nungarra ...	28	2	6	2
Murrum	...	...	...	...
Burnerbinmah ...	12	3	Nil	...
Barnong... ...	Nil	...	...	...
Mellenbye ...	13	4	...	...
Yalgoo	15	1	...	...
Wagga Wagga...	...	...	...	...
Gabyon	10	1	...	...
Tallyrang ...	Nil	...	...	...
Gullewa	4	1	...	...
Muralgarra ...	...	...	...	...
Wydgee	17	2	7	1
Wearagaminda...	16	2	...	...
Gullewa House...	12	3	...	...
South-West Division (Northern Part):				
Murchison House	26	5	...	...
Mt. View ...	Nil	...	...	...
Mumby	60	5	Nil	...

RAINFALL—*continued.*

Stations.	October. No. of points, 100 = 1in.	October. No. of wet days.	November. No. of points, 100 = 1in.	November. No. of wet days.
SOUTH-WEST (Northern)—*contd.*				
Yuin	19	1	...	...
Northampton ...	109	5	7	1
Oakabella ...	...	...	...	...
Narra Tarra ...	...	...	...	...
Tibradden ...	121	6	14	2
Myaree	100	4	...	...
Sand Springs ...	98	3	...	...
Mullewa... ...	22	3	3	2
Chapman Experimental Farm...	93	3	Nil	...
Kockatea ...	57	3	...	...
Bootenal ...	...	...	...	...
Geraldton ...	68	5	6	3
White Peak ...	171	6	...	...
Greenough ...	83	4	Nil	...
Bokara	85	4	22	2
Dongara ...	42	3	Nil	...
Brookman's Hills	37	3	...	...
Strawberry ...	...	...	...	...
Nangetty ...	...	...	...	...
Mingenew ...	37	4	19	3
Urella	43	4	Nil	...
Yandenooka ...	...	...	...	...
Rothesay ...	...	...	...	...
Ninghan... ...	Nil	...	...	...
Field's Find ...	12	1	Nil	...
Condingnow ...	84	2	Nil	...
Carnamah ...	28	4	3	1
Watheroo ...	28	2	6	2
Nergaminon ...	53	3	11	3
Dandaragan ...	102	4	37	5
Moora	31	2	16	3
Yatheroo ...	...	...	...	...
Walebing ...	69	4	26	4
Round Hill ...	60	4	7	2
New Norcia ...	59	3	34	7
Wannamel ...	52	3	56	6
SOUTH-WESTERN DIVISION, CENTRAL (COASTAL):				
Gingin	62	3	42	5
Belvoir	91	4	77	9
Mundaring ...	183	4	...	...
Wandu	120	6	118	12
Guildford ...	110	6	78	7
Kalbyamba ...	166	5	81	8
Canning W't'r'w'ks	170	4	143	9
Perth Gardens ...	145	5	60	7

Stations.	October. No. of points, 100 = 1in.	October. No. of wet days.	November. No. of points, 100 = 1in.	November. No. of wet days.
SOUTH-WEST (Coastal)—*contd.*				
Perth Observatory	158	5	69	8
Highgate Hill ...	129	5	68	6
Subiaco	150	4	51	5
Claremont ...	64	...	29	...
Wanneroo ...	122	3	72	4
Jandakot ...	238	3	82	7
Fremantle ...	116	3	51	7
Rottnest... ...	68	3	37	7
Armadale ...	208	3	...	...
Rockingham ...	174	3	41	5
Mundijong ...	180	4	151	11
Jarrahdale ...	252	5	177	10
Jarrahdale (Norie)	311	5	202	7
Serpentine ...	233	6	115	9
Mandurah ...	206	3	90	9
Pinjarra (Blythewood)	197	5	145	10
Pinjarra	201	4	157	8
Yarloop	257	3	126	10
Harvey	248	5	139	9
Upper Murray ...	312	6	225	11
SOUTH-WEST, CENTRAL PART (INLAND):				
Hatherley ...	26	2	...	...
Dowerin ...	24	3	...	...
Momberkine ...	41	4	36	4
Monglin... ...	...	...	...	...
Warramuggin ...	46	2	26	1
Newcastle ...	73	2	65	4
Emungan ...	32	5	...	...
Eumalga ...	139	3	67	4
Eadine	39	2	55	6
Northam ...	51	3	39	7
Grass Valley ...	...	...	...	...
Meckering ...	43	4	82	4
Cunderdin ...	42	2	58	3
Codg-Codgen ...	32	4	...	...
Yarragin ...	23	3	...	...
Doongin... ...	36	3	...	...
Cuttenning ...	44	5	...	...
Whitehaven ...	...	...	...	...
Cardonia ...	42	2	45	3
Sunset Hills ...	103	5	...	...
Jelcobine ...	211	6	61	6
Cobham... ...	83	6	36	5
Yenelin	56	4	...	...
Mt. Caroline ...	16	3	74	

RAINFALL—*continued.*

Stations.	October. No. of points. 100 = 1in.	October. No. of wet days.	November. No. of points. 100 = 1in.	November. No. of wet days.
South-West (Central)—*contd.*				
York	79	4	55	6
Dalebridge ...	115	4	76	4
Beverley ...	137	3	32	3
Bally Bally ...	109	5	...	...
Oakdale	176	7	...	...
Barrington ...	85	5	36	3
Qualin	109	4	35	2
Stock Hill ...	161	4	56	2
Sunning Hill ...	153	5	78	10
Brookton ...	117	3	...	...
Wandering ...	258	3	177	7
Glen Ern ...	200	7	...	...
Pingelly ...	141	4	104	3
Yornaning ...	150	5	73	9
Marradong ...	274	4	112	9
Crooked Pool ...	183	8	...	...
Bannister ...	279	3	...	...
Wonnaminta ...	208	9	...	...
Narrogin ...	203	7	65	5
Narrogin State Farm	227	5	52	4
Wickepin ...	125	5	...	...
Gillimaning ...	117	7	...	...
Bunking ...	213	6	62	2
Bullock Hills ...	238	6	...	...
Bullingarra ...	...	...	...	...
South-West Division (Southern Part):				
Bunbury ...	256	6	71	8
Brunswick ...	247	3	...	...
Collie	278	8	153	9
Glen Mervyn ...	301	6	136	6
Donnybrook ...	286	7	130	8
Boyanup ...	258	4	107	7
Ferndale ...	343	9	...	...
Busselton ...	189	11	64	9
Quindalup ...	179	9	87	9
Cape Naturaliste	152	8	63	8
Glen Lossie ...	239	9	82	10
Lower Blackwood	200	9	129	9
Karridale ...	164	11	124	12
Cape Leeuwin ...	193	16	89	15
Biddellia ...	...	...	...	...
The Warren ...	191	13	...	...
Lake Muir ...	280	9	...	...
The Peninsula ...	...	...	...	...

Stations.	October. No. of points. 100 = 1in.	October. No. of wet days.	November. No. of points. 100 = 1in.	November. No. of wet days.
South-West—(Southern)—*cont.*				
Mordalup ...	250	8	...	...
Deeside	254	10	...	...
Riverside ...	128	5	...	...
Balbarup ...	280	10	129	7
Wilgarup ...	375	15	118	8
Cundinup ...	256	5	...	...
Bridgetown ...	331	12	114	10
Westbourne ...	295	11	...	...
Hilton	178	3	...	...
Greenbushes ...	397	7	158	7
Greenfields ...	271	8	...	...
Glenorchy ...	283	7	...	...
Williams ...	215	6	54	3
Arthur	190	6	67	3
Rifle Downs ...	...	...	...	...
Darkan	253	4	...	...
Wagin	82	3	49	3
Glencove ...	300	7	108	5
Dyliabing ...	269	10	112	8
Katanning ...	388	9	54	5
Kojonup ...	447	11	69	5
Broomehill ...	271	10	50	4
Woolgarup ...	366	9	43	1
Sunnyside ...	334	8	67	7
Talbot House ...	144	4	51	3
Woodyarrup ...	...	...	...	...
Mianelup ...	285	10	...	...
Cranbrook ...	360	7	77	6
Toolbrunup ...	303	8	73	2
Tambellup ...	510	9	77	3
Blackwattle ...	360	8	...	...
Woogenellup ...	402	10	...	...
Mt. Barker ...	457	10	101	8
Kendenup ...	411	12	111	5
St. Werburgh's...	603	11	113	6
Forest Hill ...	641	14	...	...
Wilson's Inlet ...	564	14	110	10
Grasmere ...	456	15	171	11
Albany	514	13	159	13
King River ...	573	12	113	4
Point King ...	300	11	156	8
Breaksea ...	414	14	143	15
Wattle Hill ...	485	18	136	11
Cape Riche ...	469	8	...	...
Cherilallup ...	273	7	93	7
Pallinup... ...	329	7	...	...
Bremer Bay ...	443	12	71	5
Peppermint Grove	536	11	61	4
Jarramongup ...	...	...	...	...
Chillinup ...	300	9	...	...

RAINFALL—*continued.*

Stations.	October. No. of points. 100 = 1in.	October. No. of wet days.	November. No. of points. 100 = 1in.	November. No. of wet days.
Eastern Division:				
Dural	23	2	...	...
Wiluna	2	1	1	1
Gum Creek ...	Nil	...	Nil	...
Mt. Sir Samuel ...	18	2	13	1
Lawlers	7	4	1	1
Leinster G.M. ...	...	...	...	...
Darda	...	...	...	...
Lake Darlôt ...	...	...	...	...
Duketon ...	...	...	...	...
Salt Soak ...	29	3	...	...
Mt. Leonora ...	37	3	101	1
Mt. Malcolm ...	35	2	39	1
Mt. Morgans ...	66	3	90	2
Burtville ...	...	...	...	...
Laverton ...	34	2	237	1
Murrin Murrin ...	56	2	32	1
Yundamindera ...	29	2	67	2
Tampa	5	1	4	1
Kookynie ...	22	3	78	3
Niagara	14	2	73	3
Yerilla	33	1	...	...
Quandinnie ...	...	...	...	...
Edjudina ...	61	3	...	...
Menzies	35	3	57	1
Mulline	22	2	30	2
Waverley ...	...	...	...	...
Goongarrie ...	69	3	40	1
Mulwarrie ...	94	...	10	2
Bardoc	58	3	22	2
Broad Arrow ...	52	3	23	2
Kurnalpi ...	73	4	12	2
Bulong	43	3	34	4
Kanowna ...	25	3	26	2
Kalgoorlie ...	40	3	17	2
Coolgardie ...	61	5	21	3
Burbanks ...	56	5	11	2
Woolubar ...	46	4	10	1
Widgiemooltha ...	61	4	27	3
50-Mile Tank ...	58	6	30	3
Waterdale ...	60	4	10	1
Norseman ...	55	6	50	3
Lake View ...	45	6	...	...
Bulla Bulling ...	52	5	8	3
Boondi	31	4	27	4
Boorabbin ...	27	3	14	3
Koorarawalyee ...	35	3	18	1
Karalee	22	2	30	1

Stations.	October. No. of points. 100 = 1in.	October. No. of wet days.	November. No. of points. 100 = 1in.	November. No. of wet days.
Eastern—*contd.*				
Yellowdine ...	20	1	54	2
Southern Cross ...	53	2	8	2
Parker's Range ...	50	7	31	4
Parker's Road ...	...	...	...	...
Mt. Jackson ...	...	...	...	...
Bodallin ...	13	2	20	1
Glen Elg Rocks ...	44	4	60	3
56-Mile	49	4	31	1
Emu Rocks ...	19	5	39	4
Burracoppin ...	...	...	...	...
Baandee ...	21	2	10	1
Kellerberrin ...	33	4	33	2
Merredin ...	17	4	42	3
Nangeenan ...	10	1	13	1
Mangowine ...	...	...	...	...
Wattoning ...	...	...	...	...
Noongarin ...	5	2	Nil	...
163-Mile	23	4	82	...
126-Mile	25	1	...	...
90-Mile	9	1	Nil	...
Cowjanup ...	152	10	...	...
Eucla Division:				
Ravensthorpe ...	159	10	73	7
Coconarup ...	165	10	...	...
Hopetoun ...	174	8	123	2
Fanny's Cove ...	97	7	...	...
Park Farm ...	133	9	...	...
Esperance ...	86	9	107	4
Gibson's Soak ...	146	10	...	...
30-Mile Condenser	129	8	...	...
Swan Lagoon ...	89	7	...	...
Grass Patch ...	92	4	...	...
Myrup	125	9	98	4
Lynburn ...	155	11	...	...
Boyatup	173	9	...	...
Middle Island ...	...	...	...	...
Point Malcolm ...	164	13	43	3
Israelite Bay ...	106	11	22	2
Balbinia	...	...	...	...
Frazer Range ...	...	...	...	...
Balladonia ...	67	3	16	3
Southern Hills ...	105	3	...	...
Eyre	11	4	40	1
Mundrabillia ...	26	3	...	...
Eucla	10	6	7	1

The Observatory, Perth,
6th December, 1905.

W. E. COOKE,
Government Astronomer.

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